Cisco Virtual Wireless Controller Deployment Guide

Document ID: 113677

Introduction

Prior to release 7.3, wireless LAN (WLAN) controller software ran on dedicated hardware you were expected to purchase. The Virtual Wireless LAN Controller (vWLC) runs on general hardware under an industry standard virtualization infrastructure. The vWLC is ideal for small and mid−size deployments with a virtual infrastructure and require an on−premises controller. Distributed branch environments can also benefit with a centralized virtual controller with fewer branches required (up to 200).

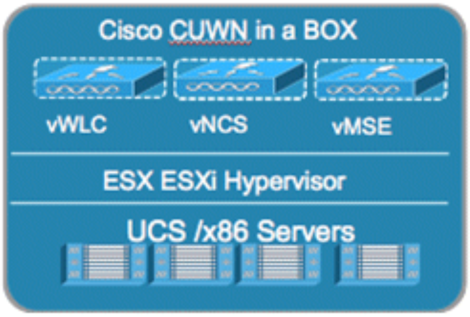
vWLCs are not a replacement of shipping hardware controllers. The function and features of the vWLC offer deployment advantages and benefits of controller services where data centers with virtualization infrastructure exist or are considered.

Advantages of the vWLC:

- Flexibility in hardware selection based on your requirements.
- Reduced cost, space requirements, and other overheads since multiple boxes can be replaced with single hardware running multiple instances of controllers, network management devices (NCS) and other servers (ISE, MSE, VSG / firewall).
- Independent and mutually exclusive instances allow administrators to use multiple virtual controllers to manage different campuses (or even to manage multiple customer sites) using the same hardware.
- Enable features provided by the virtualization software, including High Availability, failover protection, and ease of migration.

VMware benefits with the vWLC:

- **vSphere**: A virtualization infrastructure package from VMware, which includes ESX/ESXi hypervisor, vMotion, DRS, HA, Fault Tolerance, vSphere Distributed Switch, and more.
- **vCenter Server**: The VMware vCenter Server (formerly VMware VirtualCenter) provides a scalable and extensible platform that forms the foundation for virtualization management:
    - Centralized control and visibility at every level of virtual infrastructure
    - Pro−active management with vSphere
    - Scalable and extensible management platform with a broad partner ecosystem



Prerequisites

Virtual Controller Support

- Platform: AIR−CTVM−K9
- Hardware: Cisco UCS, UCS Express, HP and IBM servers
- VMware OS: ESX/ESXi 4.x/5.x
- FlexConnect Mode: central and local switching
- Licensing: Node locked licenses to UDI (eval 60 days)
- Maximum number of access points (APs): 200
- Maximum number of Clients: 3000
- Maximum number of sites up to 200
- Throughput performance up to 500 Mbps per virtual controller
- Management with Cisco Prime Infrastructure 1.2 and above

Virtual WLAN Controller Unsupported Features

- Data DTLS
- OEAP (no data DTLS)
- Rate Limiting
- Internal DHCP server
- Mobility/Guest Anchor
- Multicast−Unicast mode
- PMIPv6
- Outdoor Mesh Access Points; an Outdoor AP with FlexConnect mode will work

Single Virtual Controller Resource Requirement

- CPU: 1 virtual CPU
- Memory: 2 GB
- Disk Space: 8 GB
- Network Interfaces: 2 or more virtual Network Interface cards (vNICs)

Suggested Hardware Recommendations for Hosting Cisco Virtual Controllers

- UCS R210−2121605W Rack Mount Server (2 RU):
    - 2 * Intel Xeon CPU X5670 @ 2.93 GHz
    - 16 G memory
- IBM x3550 M3 Server:
    - 2 * Intel Xeon 5600 series processors with 4 cores each and each core capable of doing hyper threading which gives you 16 CPUs in total @3.6 GHz
    - 12G memory
- ISR G2 Services Ready Engine (SRE) using UCS Express (Stretch goal):
    - SRE 700: Single Core Intel Core Duo 1.86 GHz with 4 GB memory
    - SRE 900: Dual Core Intel Core Duo 1.86 GHz with 4 GB memory (upgradable to 8 GB)

AP Requirement

- All 802.11n APs with required software version 7.3 are supported.
- APs will be operating in FlexConnect mode only.
- AP autoconvert to FlexConnect is supported on controller.
- New APs ordered will ship with 7.3 software from manufacturing.
- Existing APs must be upgraded to 7.3 software before joining a virtual controller.

  Note: The Virtual Controller in release 7.3 uses Self Signed Certificates (SSC) as against the Manufacturing Installed Certificates (MIC) in the traditional controller. The AP will be able to validate the SSC certificate provided by the virtual controller before joining. See AP Considerations in the Troubleshooting section for more details.

Components Used

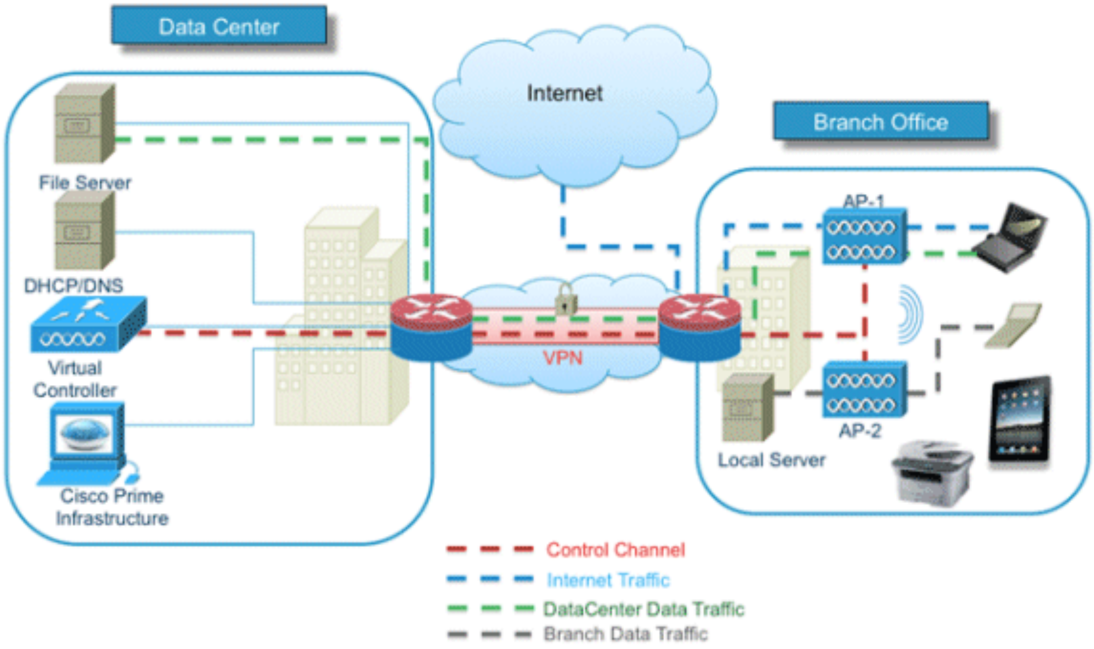
The information in this document is based on these software and hardware versions:

- Cisco Catalyst Switch
- Wireless LAN Controllers Virtual Appliance
- Wireless LAN Controller 7.3 Software
- Cisco Prime Infrastructure 1.2
- 802.11n Access Points in FlexConnect Mode
- DHCP server
- DNS Server
- NTP
- Wireless Client Laptop, Smartphone, and Tablets (Apple iOS, Android, Windows, and Mac)

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Topology

In order to properly implement and test the Cisco vWLC, a minimal network setup is required, similar to the diagram shown in this section. You need to simulate a location with a FlexConnect AP in a centrally switched deployment, and/or with the addition of local and remote sites with local DHCP (better if there is also a DNS and local access to Internet).



Conventions

Refer to Cisco Technical Tips Conventions for more information on document conventions.

Release Notes

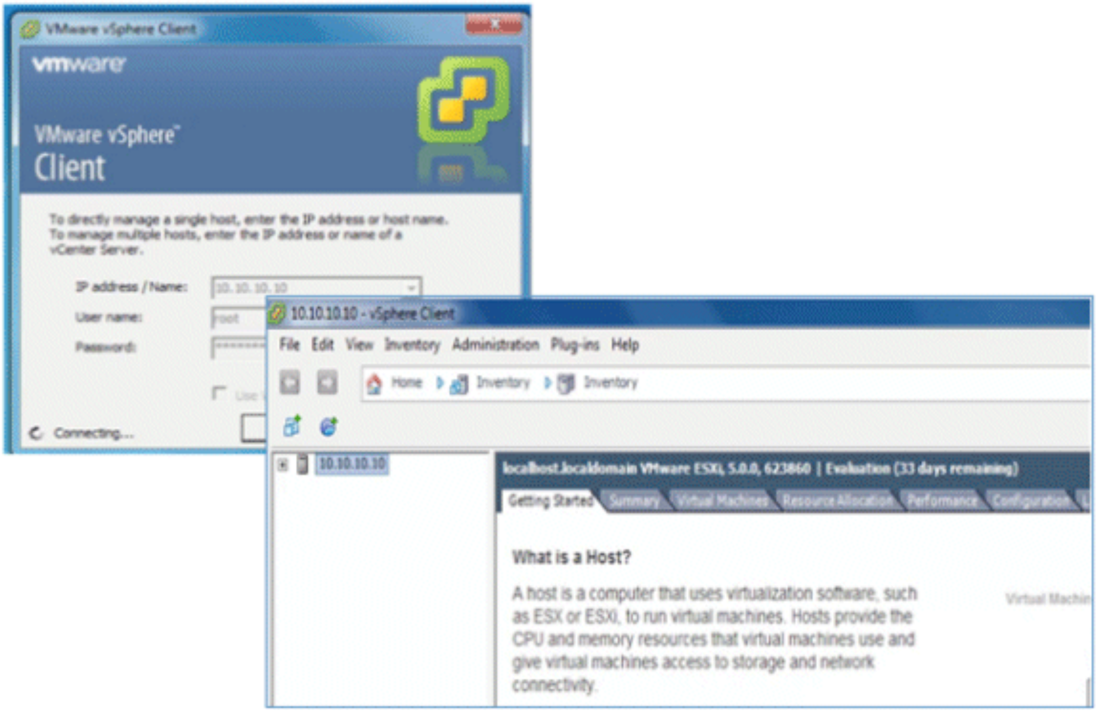
Cisco Unified Wireless Network (CUWN) 7.3 Release Notes contain important information about this release. Log in to Cisco.com for the latest release notes before loading and testing software.

Virtual Controller Installation

For deployment and management of the vWLC, you will need to download any of these VMware suites to the workstation:

- Single ESXi server management − Use VMware vSphere Client.
- Multiple ESXi servers requires vCenter − Advance features are also tied with vCenter which needs separate licenses (vMotion, and so on).

Start the **VMware vSphere Client**, and log in to the ESXi server.



To directly manage a single host, enter the IP address or host name. To manage multiple hosts, enter the IP address or name of a vCenter Server.

IP address / Name: 10.10.10.10

User name: root

Password: ********

Connecting...

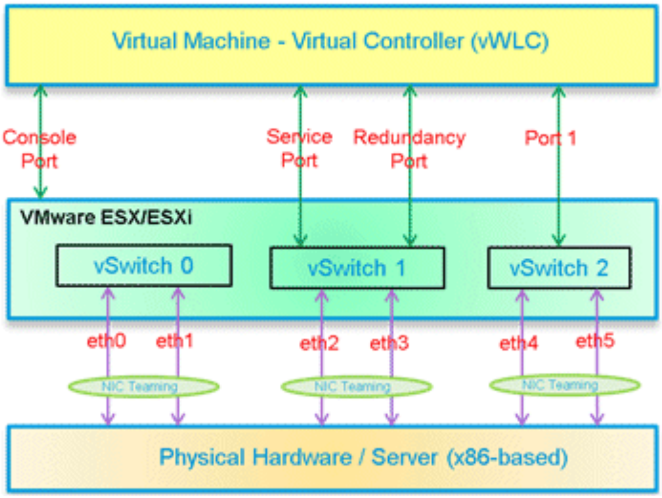
localhost.localdomain VMware ESXi, 5.0.0, 623860 | Evaluation (33 days remaining)

What is a Host?

A host is a computer that uses virtualization software, such as ESX or ESXi, to run virtual machines. Hosts provide the CPU and memory resources that virtual machines use and give virtual machines access to storage and network connectivity.

Virtual Controller Virtual Interfaces

- Management Interface
- Virtual Interface
- Dynamic Interface
- AP Manager Interface



Switch Interface Configuration Connected to UCS Server

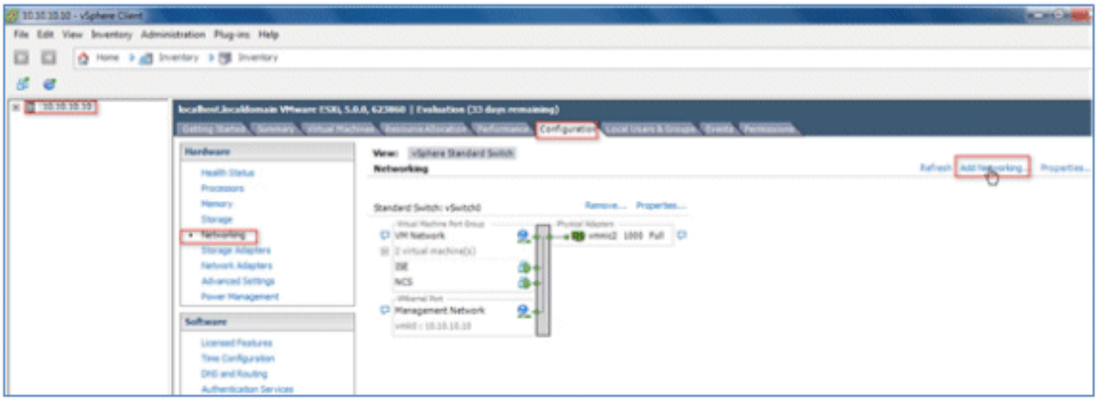
This section provides a sample configuration of the Cisco Catalyst interface connection to the ESXi server for the virtual switch as trunk interface. The management interface can be connected to an access port on the switch.

```
interface GigabitEthernet1/1/2
 description ESXi Management
 switchport access vlan 10
 switchport mode access
!
```

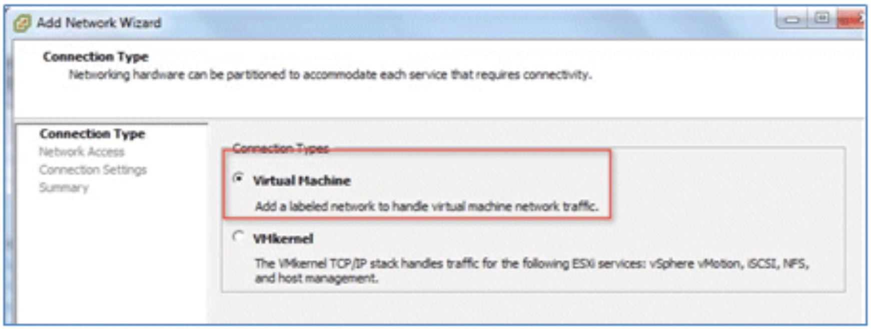
```
interface GigabitEthernet1/1/3
 description ESXi Trunk
 switchport trunk encapsulation dot1q
 switchport mode trunk
end
```

Complete these steps:

1. Create two separate virtual switches in order to map to the virtual controller Service and Data Port. Go to **ESX** > **Configuration** > **Networking**, and click **Add Networking**.



2. Select **Virtual Machine**, and click **Next**.



Add Network Wizard

Connection Type

Networking hardware can be partitioned to accommodate each service that requires connectivity.

Connection Types

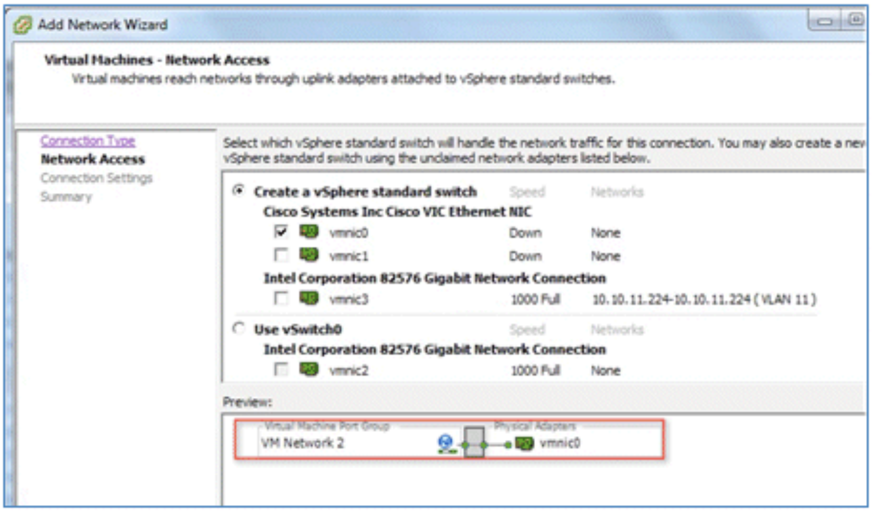
● Virtual Machine

Add a labeled network to handle virtual machine network traffic.

○ VMkernel

The VMkernel TCP/IP stack handles traffic for the following ESXi services: vSphere vMotion, iSCSI, NFS, and host management.

3. Create a vSwitch and assign a physical NIC in order to connect the vWLC service port. The service port does not have to be connected to any part of the network (typically disconnected/unused). As a result, any NIC (even disconnected) can be used for this vSwitch.



Add Network Wizard

Virtual Machines - Network Access

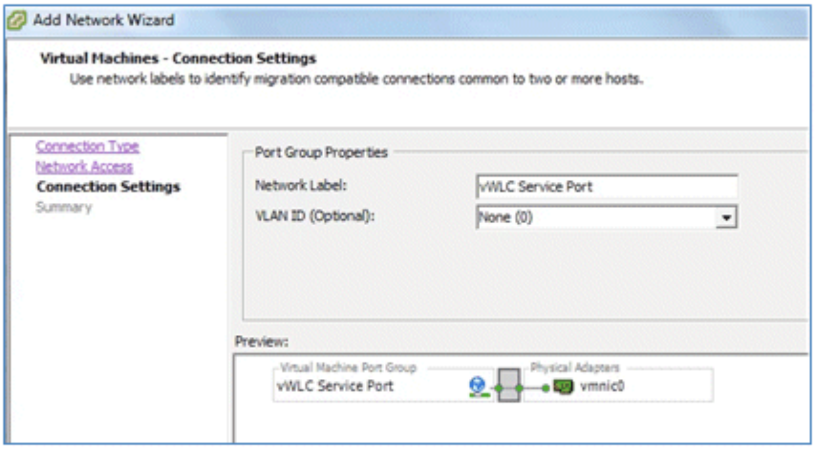
Virtual machines reach networks through uplink adapters attached to vSphere standard switches.

Select which vSphere standard switch will handle the network traffic for this connection. You may also create a new vSphere standard switch using the unclaimed network adapters listed below.

	Speed	Networks
● Create a vSphere standard switch		
Cisco Systems Inc Cisco VIC Ethernet NIC		
☑ vmnic0	Down	None
□ vmnic1	Down	None
Intel Corporation 82576 Gigabit Network Connection		
□ vmnic3	1000 Full	10.10.11.224-10.10.11.224 (VLAN 11)
○ Use vSwitch0		
Intel Corporation 82576 Gigabit Network Connection		
□ vmnic2	1000 Full	None

Preview:

4. Click **Next**.
5. Provide a label (in this example, **vWLC Service Port**).
6. Select **None (0)** for VLAN ID as the service port is typically an access port.



Add Network Wizard

Virtual Machines - Connection Settings

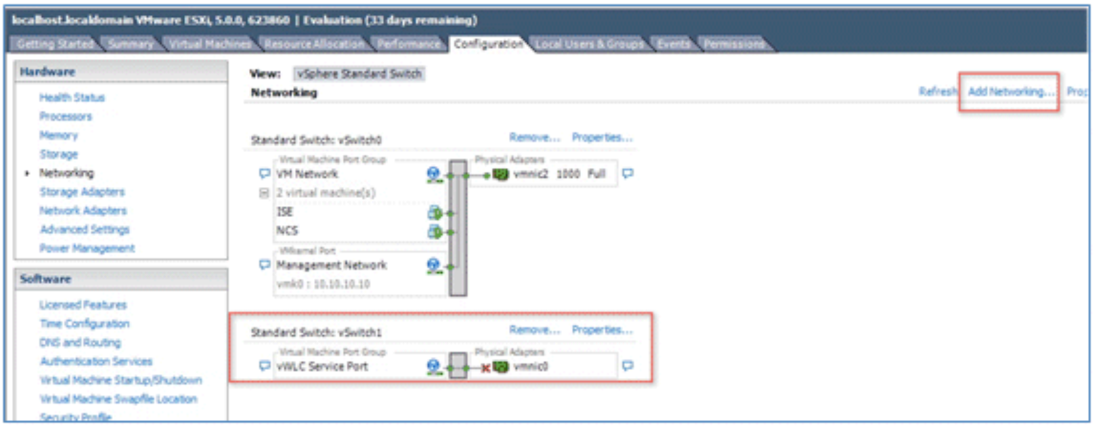
Use network labels to identify migration compatible connections common to two or more hosts.

Network Label: vWLC Service Port

VLAN ID (Optional): None (0)

vWLC Service Port — vmnic0

7. Click **Next**.
8. Here, you see vSwitch1 is created for vWLC Service Port. Click **Add Networking** in order to repeat for the Data Port.



localhost.localdomain VMware ESXi, 5.0.0, 623860 | Evaluation (33 days remaining)

Standard Switch: vSwitch0

VM Network — vmnic2 1000 Full

2 virtual machine(s)

ISE

NCS

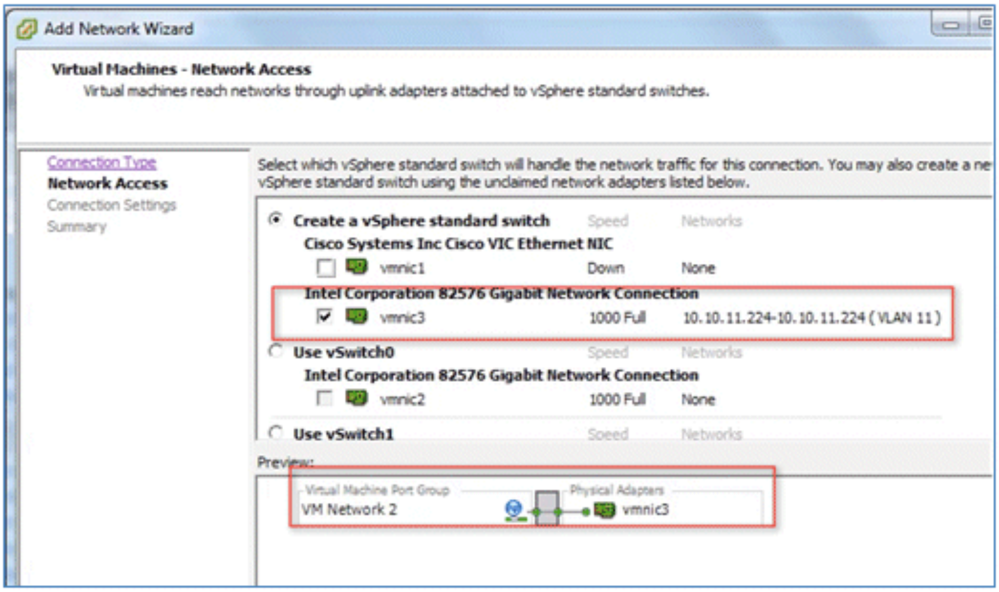
Management Network

vmk0 : 10.10.10.10

Standard Switch: vSwitch1

vWLC Service Port — vmnic0

9. For the new vSwitch, select the physical NIC(s) connected on a trunk port if there are multiple NICs / portgroup assigned to an etherchannel on the switch.
10. Add the NIC.



Add Network Wizard

Virtual Machines - Network Access

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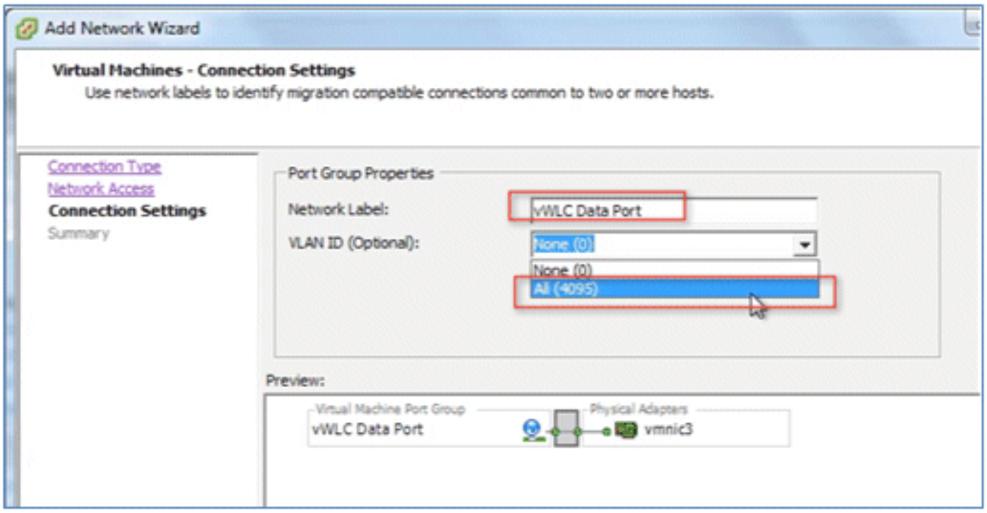
Select which vSphere standard switch will handle the network traffic for this connection. You may also create a ne vSphere standard switch using the unclaimed network adapters listed below.

	Speed	Networks
● Create a vSphere standard switch		
Cisco Systems Inc Cisco VIC Ethernet NIC		
□ vmnic1	Down	None
Intel Corporation 82576 Gigabit Network Connection		
☑ vmnic3	1000 Full	10.10.11.224-10.10.11.224 (VLAN 11)
○ Use vSwitch0		
Intel Corporation 82576 Gigabit Network Connection		
□ vmnic2	1000 Full	None
○ Use vSwitch1		

VM Network 2 — vmnic3

11. Click **Next**.
12. Provide a label (in this example, **vWLC Data Port**).
13. For VLAN ID, select **ALL(4095)** since this is connected to a switch trunk port.



Virtual Machines - Connection Settings

Use network labels to identify migration compatible connections common to two or more hosts.

Port Group Properties

Network Label: vWLC Data Port

VLAN ID (Optional): None (0)

None (0)

All (4095)

Preview:

Virtual Machine Port Group: vWLC Data Port

Physical Adapters: vmnic3

14. Click **Next** until you complete the steps to add the vSwitch.

VMware Promiscuous Mode Definition

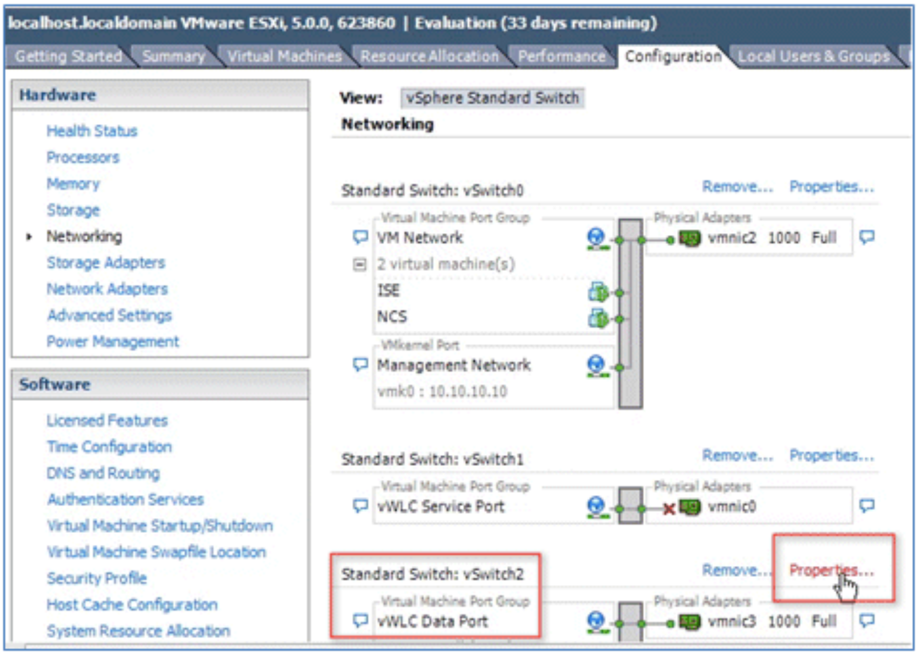
Promiscuous mode is a security policy which can be defined at the virtual switch or portgroup level in vSphere ESX/ESXi. A virtual machine, Service Console, or VMkernel network interface in a portgroup which allows the use of promiscuous mode can see all network traffic traversing the virtual switch.

By default, a guest operating system's virtual network adapter only receives frames that are meant for it. Placing the guest's network adapter in promiscuous mode causes it to receive all frames passed on the virtual switch that are allowed under the VLAN policy for the associated portgroup. This can be useful for intrusion detection monitoring or if a sniffer needs to analyze all traffic on the network segment.

The vWLC Data Port requires the assigned vSwitch to accept Promiscuous mode for proper operations.

Complete these steps:

1. Locate vSwitch2 (assigned for vWLC Data Port), and click **Properties**.



localhost.localdomain VMware ESXi, 5.0.0, 623860 | Evaluation (33 days remaining)

View: vSphere Standard Switch

Networking

Standard Switch: vSwitch0

Virtual Machine Port Group: VM Network, 2 virtual machine(s): ISE, NCS

VMkernel Port: Management Network, vmk0 : 10.10.10.10

Physical Adapters: vmnic2 1000 Full

Standard Switch: vSwitch1

Virtual Machine Port Group: vWLC Service Port

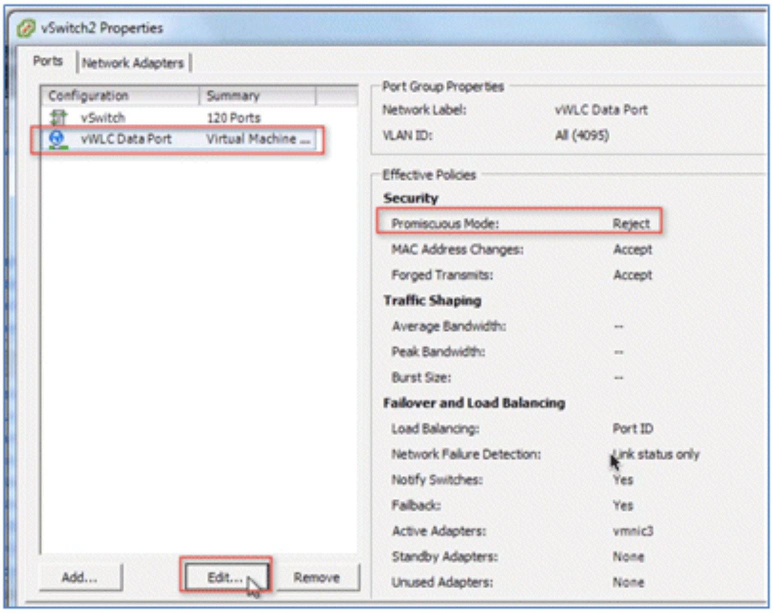
Physical Adapters: vmnic0

Standard Switch: vSwitch2

Virtual Machine Port Group: vWLC Data Port

Physical Adapters: vmnic3 1000 Full

2. Select the VMNet assigned to the vWLC Data Port (note that the default Security Promiscuous Mode is set to Reject), and click **Edit**.



Configuration	Summary
vSwitch	120 Ports
vWLC Data Port	Virtual Machine ...

Port Group Properties

Network Label: vWLC Data Port

VLAN ID: All (4095)

Effective Policies

Security

Promiscuous Mode: Reject

MAC Address Changes: Accept

Forged Transmits: Accept

Traffic Shaping

Average Bandwidth: --

Peak Bandwidth: --

Burst Size: --

Failover and Load Balancing

Load Balancing: Port ID

Network Failure Detection: Link status only

Notify Switches: Yes

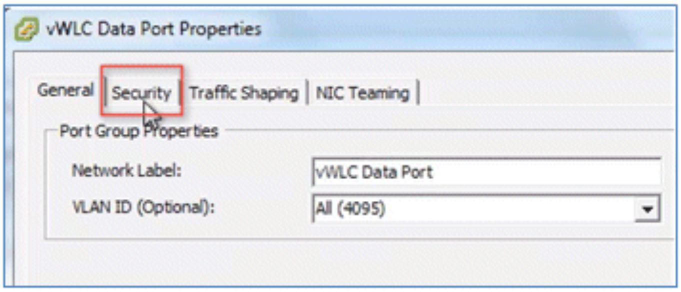
Failback: Yes

Active Adapters: vmnic3

Standby Adapters: None

Unused Adapters: None

3. In the Properties window, select the **Security** tab.

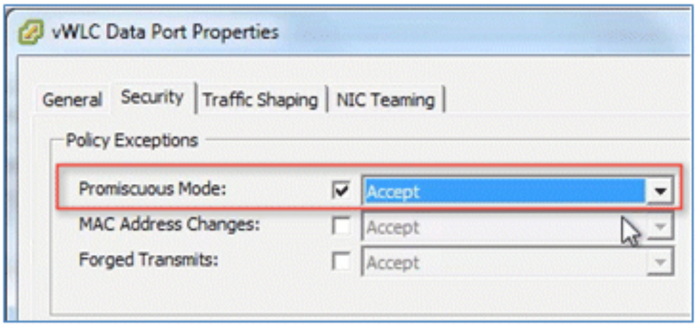


Port Group Properties

Network Label: vWLC Data Port

VLAN ID (Optional): All (4095)

4. Check the box for **Promiscuous Mode**, choose **Accept** from the drop−down list, and click **OK**.



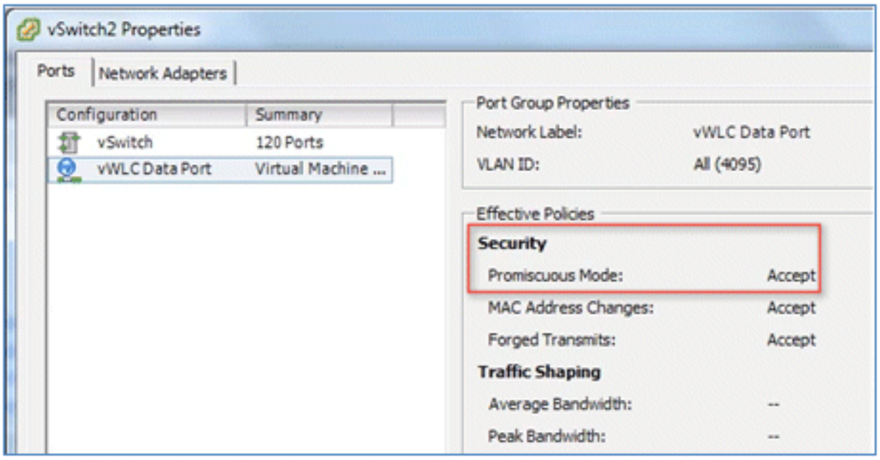
Policy Exceptions

Promiscuous Mode: ☑ Accept

MAC Address Changes: □ Accept

Forged Transmits: □ Accept

5. Confirm the change, and click **Close**.



Configuration	Summary
vSwitch	120 Ports
vWLC Data Port	Virtual Machine ...

Port Group Properties

Network Label: vWLC Data Port

VLAN ID: All (4095)

Effective Policies

Security

Promiscuous Mode: Accept

MAC Address Changes: Accept

Forged Transmits: Accept

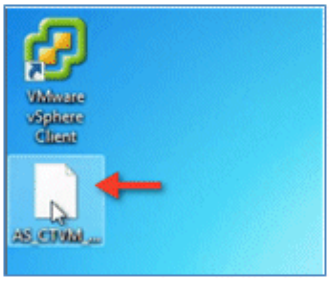
Traffic Shaping

Average Bandwidth: --

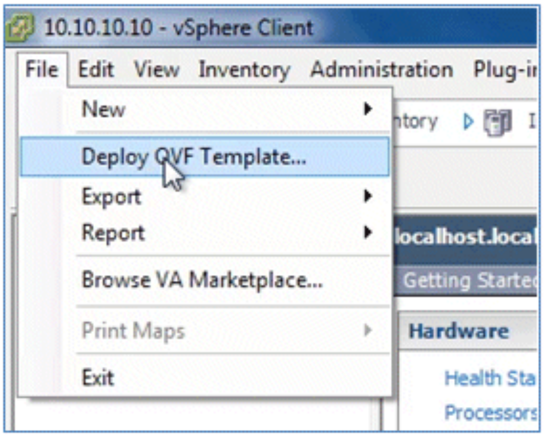
Peak Bandwidth: --

The virtual controller software is posted as an .ovf package in the Cisco software center. You can download the .ova/.ovf package and install to any other virtual application. The software comes with a free 60−day evaluation license. After the VM is started, the evaluation license can be activated and a purchased license can be automatically installed and activated later.

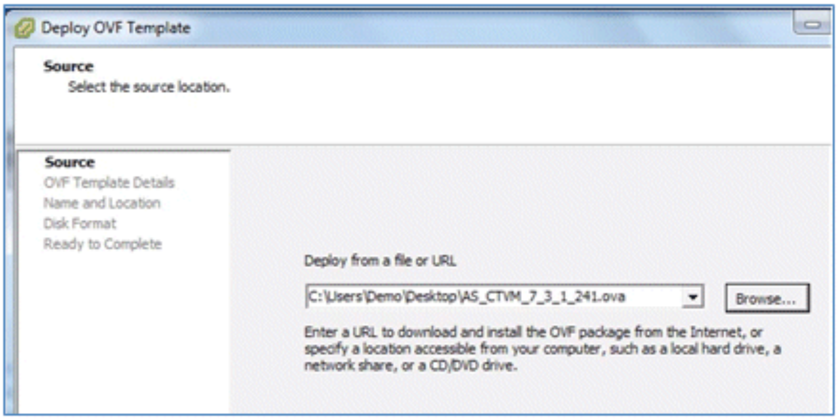
6. Download the virtual controller OVA image to the local disk.



7. Go to **ESX** > **File** > **Deploy OVF Template** in order to start the installation.



8. Browse to the location of the OVA file (downloaded from Cisco site), and click **Next**.


Deploy OVF Template

Source

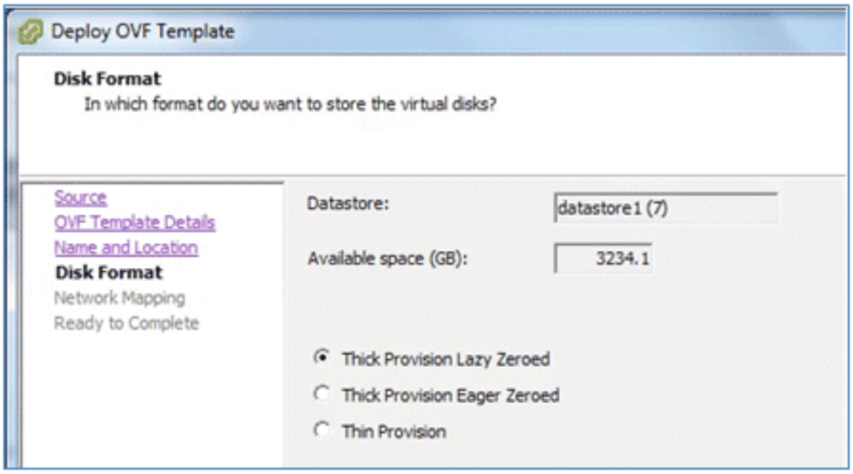
Select the source location.

Deploy from a file or URL

C:\Users\Demo\Desktop\AS_CTVM_7_3_1_241.ova

Enter a URL to download and install the OVF package from the Internet, or specify a location accessible from your computer, such as a local hard drive, a network share, or a CD/DVD drive.

9. Click **Next**.



Deploy OVF Template

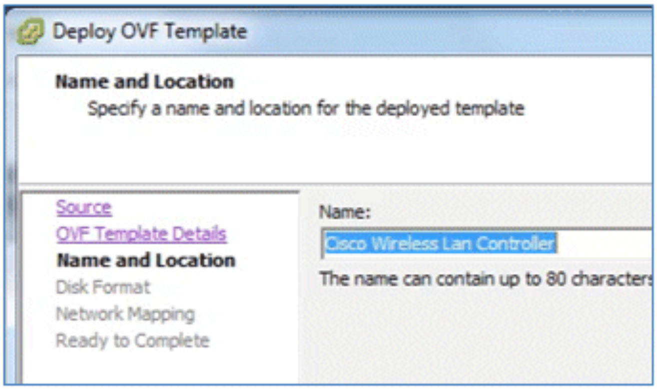
Disk Format
In which format do you want to store the virtual disks?

Datastore: datastore1 (7)

Available space (GB): 3234.1

● Thick Provision Lazy Zeroed
○ Thick Provision Eager Zeroed
○ Thin Provision

10. Provide a name for the vWLC or accept the default, and click **Next**.



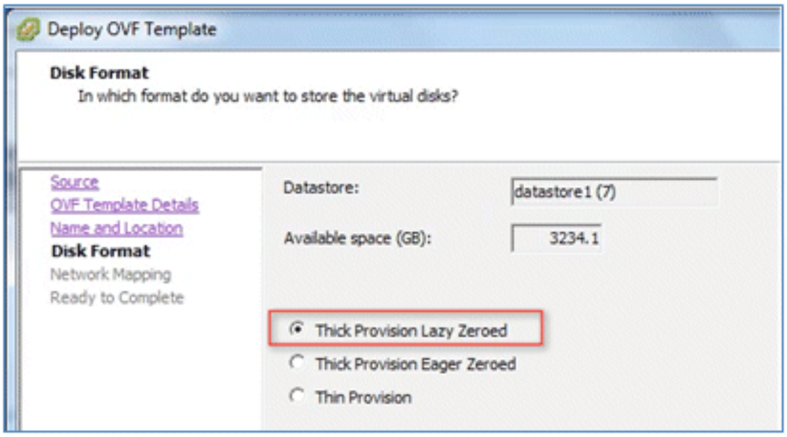
Deploy OVF Template

Name and Location
Specify a name and location for the deployed template

Name: Cisco Wireless Lan Controller

The name can contain up to 80 characters

11. Accept the default **Thick Provision Lazy Zeroed** setting, and click **Next**.



Deploy OVF Template

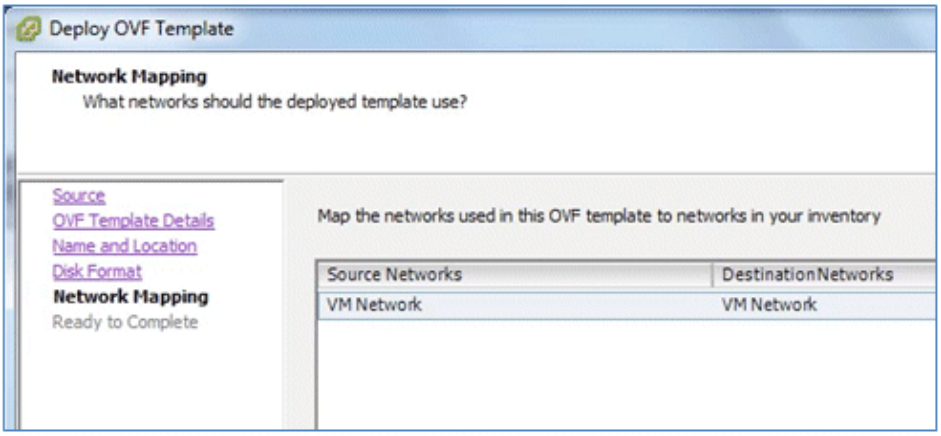
Disk Format
In which format do you want to store the virtual disks?

Datastore: datastore1 (7)

Available space (GB): 3234.1

● Thick Provision Lazy Zeroed
○ Thick Provision Eager Zeroed
○ Thin Provision

12. Accept the Network Mapping default, and click **Next**.



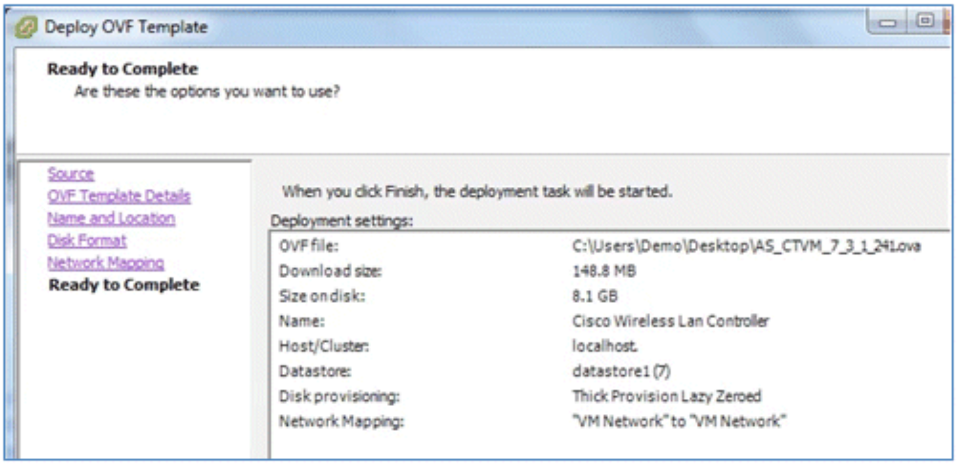
Network Mapping

What networks should the deployed template use?

Map the networks used in this OVF template to networks in your inventory

Source Networks	Destination Networks
VM Network	VM Network

13. Confirm the Deployment settings, and click **Finish** in order to begin installation.



Ready to Complete

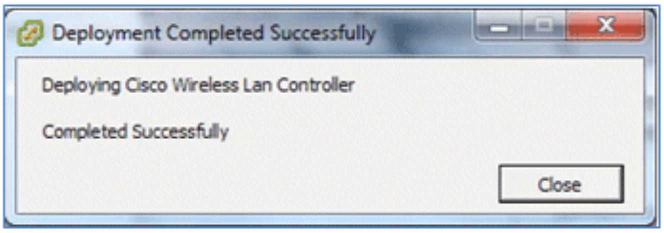
Are these the options you want to use?

When you click Finish, the deployment task will be started.

Deployment settings:

OVF file:	C:\Users\Demo\Desktop\AS_CTVM_7_3_1_241.ova
Download size:	148.8 MB
Size on disk:	8.1 GB
Name:	Cisco Wireless Lan Controller
Host/Cluster:	localhost.
Datastore:	datastore1 (7)
Disk provisioning:	Thick Provision Lazy Zeroed
Network Mapping:	"VM Network" to "VM Network"

14. Click **Close** when Deployment is complete.



Deploying Cisco Wireless Lan Controller

Completed Successfully

Two important things to note regarding upgrading virtual controllers:

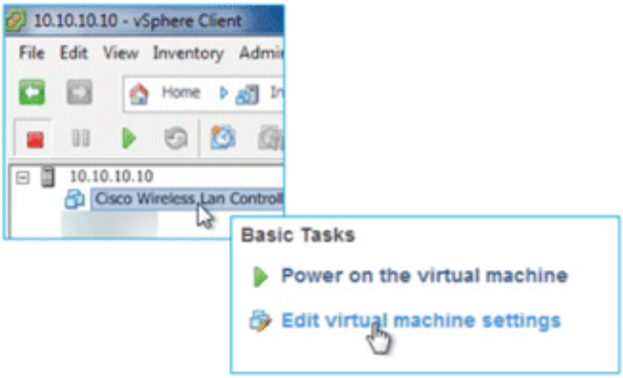
- The OVA image is needed only for first time installation.
- The .AES image can be subsequently used for upgrading/downgrading.

Virtual Controller Settings

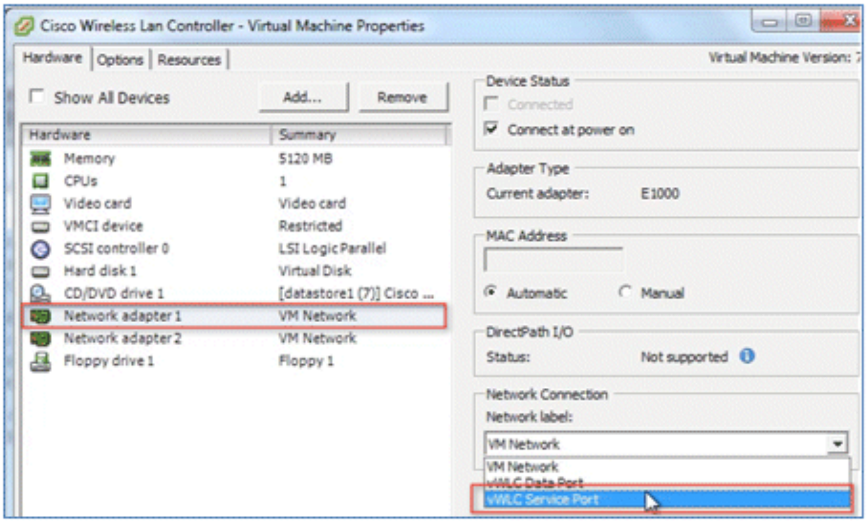
After creating the virtual controller, configure the virtual machine settings to map networking and add a virtual serial console.

Complete these steps:

1. Select the vWLC, and click **Edit virtual machine settings**.


10.10.10.10 - vSphere Client
File Edit View Inventory Admi
Home
10.10.10.10
Cisco Wireless Lan Controll
Basic Tasks
Power on the virtual machine
Edit virtual machine settings

2. Select **Network adapter 1** to **vWLC Service Port** (vSwitch created in ESX networking).


Cisco Wireless Lan Controller - Virtual Machine Properties
Hardware
Options
Resources
Virtual Machine Version: 7
Add...
Remove
VM Network
vWLC Data Port
vWLC Service Port

□ Show All Devices

Hardware	Summary
Memory	5120 MB
CPUs	1
Video card	Video card
VMCI device	Restricted
SCSI controller 0	LSI Logic Parallel
Hard disk 1	Virtual Disk
CD/DVD drive 1	[datastore1 (7)] Cisco ...
Network adapter 1	VM Network
Network adapter 2	VM Network
Floppy drive 1	Floppy 1

Device Status
□ Connected
☑ Connect at power on

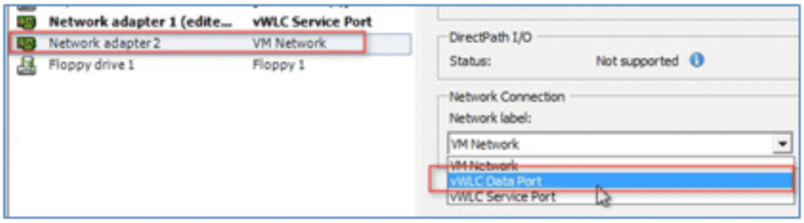
Adapter Type
Current adapter: E1000

MAC Address
● Automatic ○ Manual

DirectPath I/O
Status: Not supported

Network Connection
Network label: VM Network

3. Map **Network adapter 2** to **vWLC Data Port**.

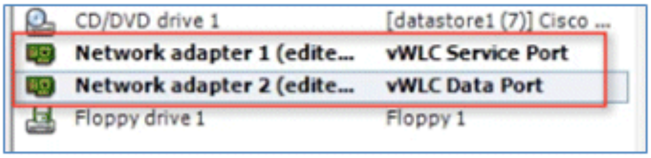


Network adapter 1 (edite...	vWLC Service Port
Network adapter 2	VM Network
Floppy drive 1	Floppy 1

DirectPath I/O
Status: Not supported

Network Connection
Network label: VM Network

4. Confirm the correct mapping.



CD/DVD drive 1	[datastore1 (7)] Cisco ...
Network adapter 1 (edite...	vWLC Service Port
Network adapter 2 (edite...	vWLC Data Port
Floppy drive 1	Floppy 1

Virtual Controller Console Port

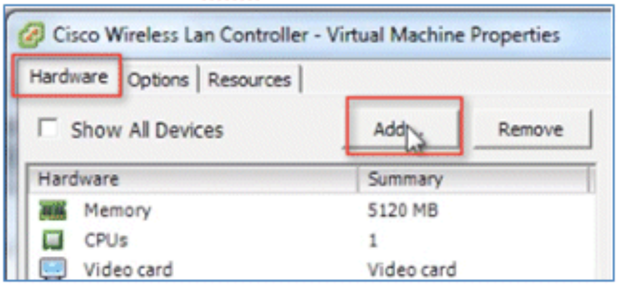
The console port gives access to the console prompt of the WLC. As a result, the VM can be provisioned with serial ports in order to connect to these. In the absence of serial ports, the vSphere Client Console is connected to the console on the vWLC.

VMware ESXi supports a virtual serial console port that can be added to the vWLC VM. The serial port can be accessed in one of these two ways:

- **Physical Serial Port on the Host**: The vWLC s virtual serial port is mapped to the hardware serial port on the server. This option is limited to the number of physical serial port(s) on the host. If in a multi−tenant vWLC scenario, this may not be ideal.
- **Connect via Network**: The vWLC s virtual serial port can be accessed using Telnet session from a remote machine to a specific port allocated for the VM on hypervisor. For example, if the hypervisor s IP address is 10.10.10.10 and the port allocated for a vWLC VM is 9090, using "telnet 10.10.10.10 9090", just like accessing a physical WLC s console using a Cisco terminal server, the vWLC s serial console can be accessed.

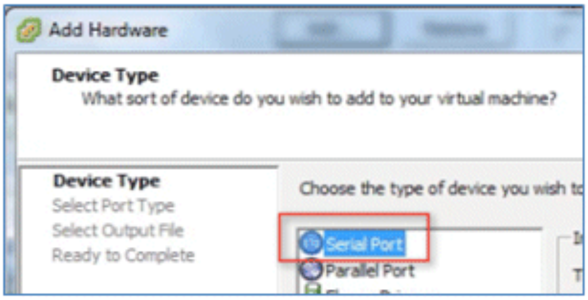
Complete these steps:

1. On the vWLC **Hardware** tab, click **Add**.



Hardware	Summary
Memory	5120 MB
CPUs	1
Video card	Video card

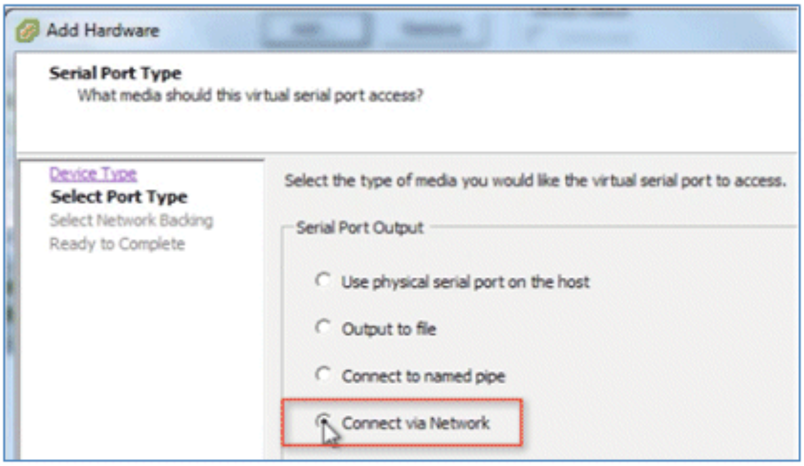
2. On the vWLC **Hardware** tab, click **Add**.



Device Type
What sort of device do you wish to add to your virtual machine?

Choose the type of device you wish t

3. In this example, choose **Connect via Network**, and click **Next**.



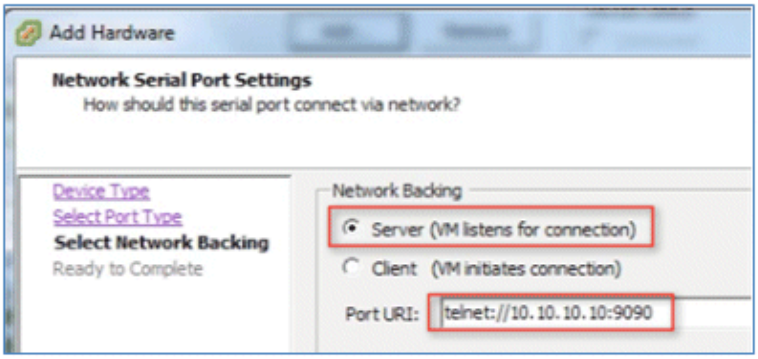
Serial Port Type
What media should this virtual serial port access?

Select the type of media you would like the virtual serial port to access.

○ Use physical serial port on the host
○ Output to file
○ Connect to named pipe
● Connect via Network

4. Go to **Select Network Backing**:

   - For Network Backing, choose **Server (VM listens for connection)**.
   - For Port URI, enter **telnet://<host>:<port>** (for example, telnet://10.10.10.10:9090).



Add Hardware

Network Serial Port Settings

How should this serial port connect via network?

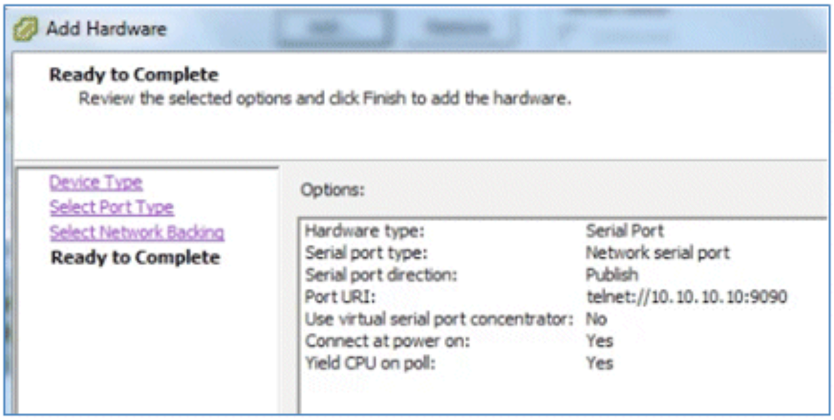
Network Backing

● Server (VM listens for connection)

○ Client (VM initiates connection)

Port URI: telnet://10.10.10.10:9090

5. Click **Next** in order to review the Options, and click **Finish**.



Add Hardware

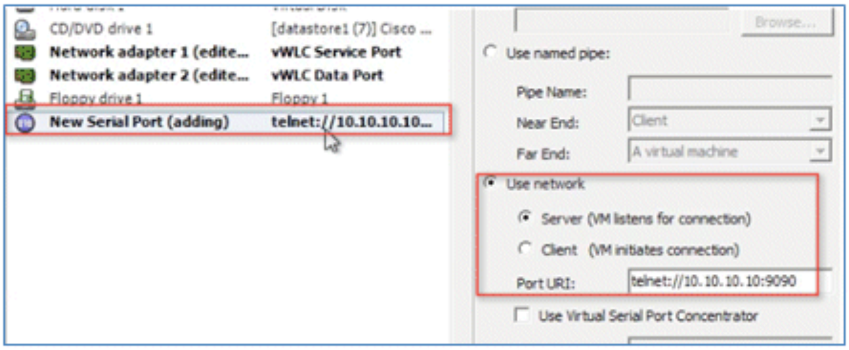
Ready to Complete

Review the selected options and click Finish to add the hardware.

Options:

Hardware type:	Serial Port
Serial port type:	Network serial port
Serial port direction:	Publish
Port URI:	telnet://10.10.10.10:9090
Use virtual serial port concentrator:	No
Connect at power on:	Yes
Yield CPU on poll:	Yes

6. Click **OK** in order to complete the configured settings.



CD/DVD drive 1	[datastore1 (7)] Cisco ...
Network adapter 1 (edite...	vWLC Service Port
Network adapter 2 (edite...	vWLC Data Port
Floppy drive 1	Floppy 1
New Serial Port (adding)	telnet://10.10.10.10...

○ Use named pipe:

Pipe Name:

Near End: Client

Far End: A virtual machine

● Use network

● Server (VM listens for connection)

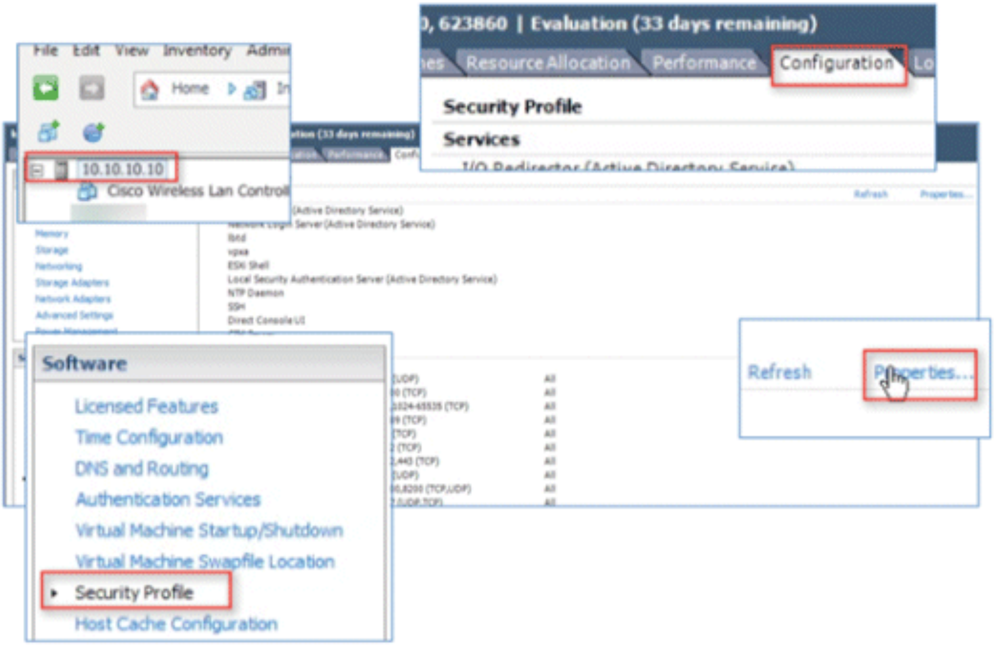
○ Client (VM initiates connection)

Port URI: telnet://10.10.10.10:9090

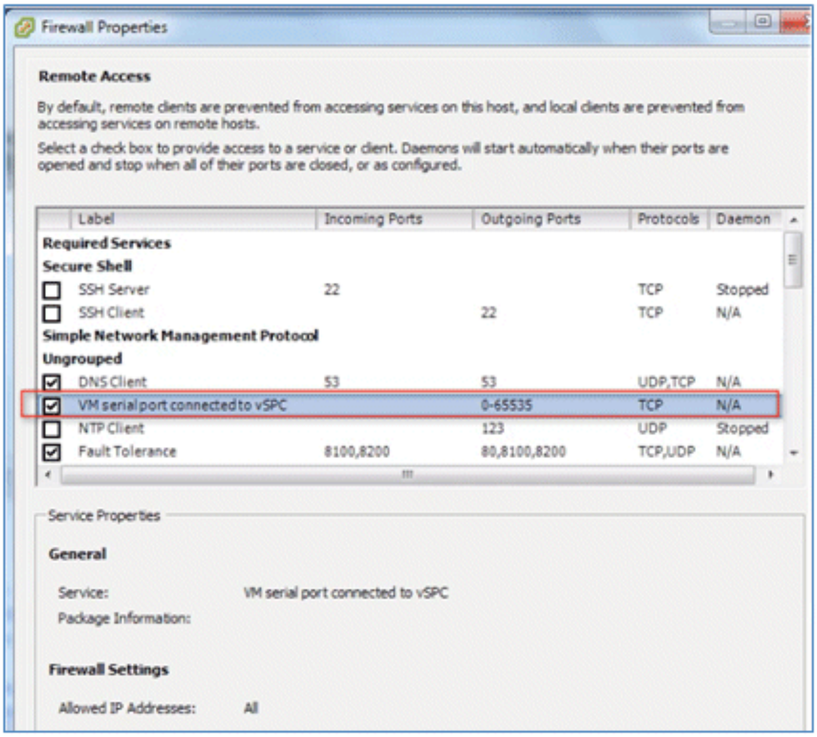
□ Use Virtual Serial Port Concentrator

In order to enable for the serial via network, ESX must be configured to allow for such requests.

7. Navigate to the ESX, click the **Configuration** tab, go to **Software** > **Security Profile**, and click on **Properties**.



8. In the **Firewall Properties** window, select **VM serial port connected to vSPC**, and click **OK**.



Remote Access

By default, remote clients are prevented from accessing services on this host, and local clients are prevented from accessing services on remote hosts.

Select a check box to provide access to a service or client. Daemons will start automatically when their ports are opened and stop when all of their ports are closed, or as configured.

Label	Incoming Ports	Outgoing Ports	Protocols	Daemon
Required Services				
Secure Shell				
☐ SSH Server	22		TCP	Stopped
☐ SSH Client		22	TCP	N/A
Simple Network Management Protocol				
Ungrouped				
☑ DNS Client	53	53	UDP,TCP	N/A
☑ VM serial port connected to vSPC		0-65535	TCP	N/A
☐ NTP Client		123	UDP	Stopped
☑ Fault Tolerance	8100,8200	80,8100,8200	TCP,UDP	N/A

Service Properties

General

Service: VM serial port connected to vSPC

Package Information:

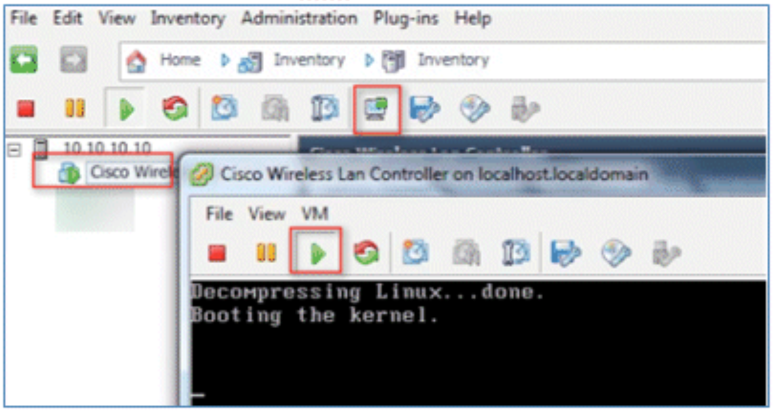
Firewall Settings

Allowed IP Addresses: All

Start up the vWLC

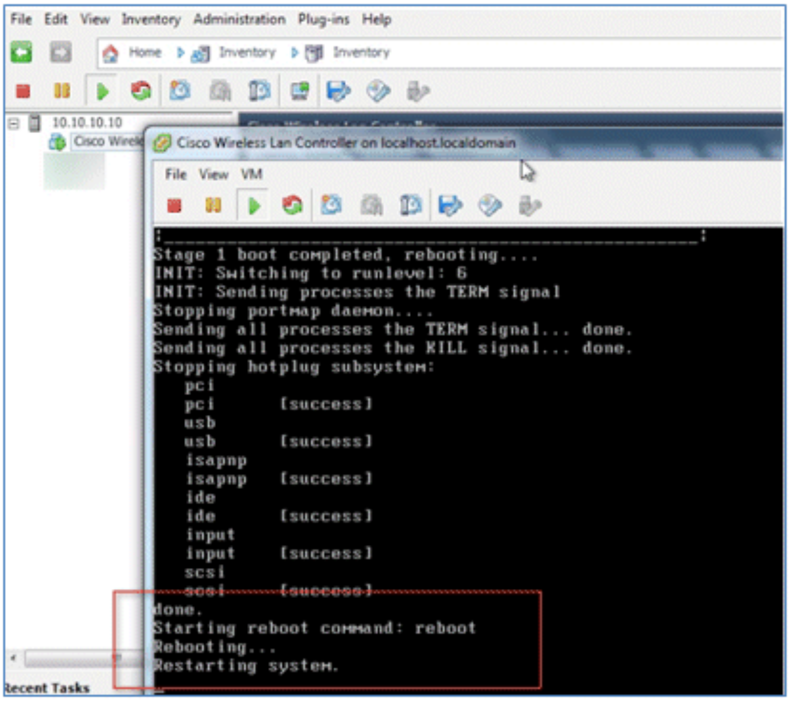
Complete these steps:

1. Start the vWLC, and select the console in order to observe the first−time installation process.


File Edit View Inventory Administration Plug-ins Help
Home
Inventory
Inventory
10.10.10.10
Cisco Wirel
Cisco Wireless Lan Controller on localhost.localdomain
File View VM

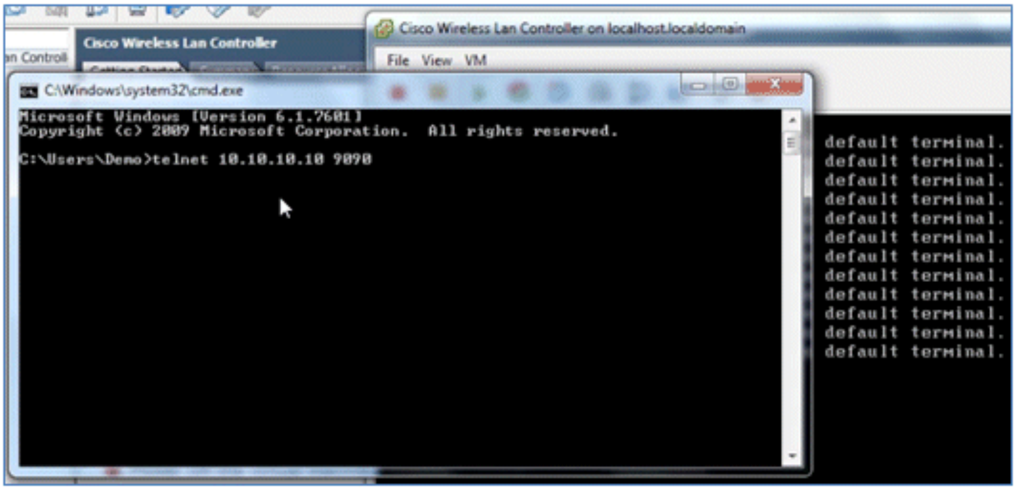
```
Decompressing Linux...done.
Booting the kernel.
```

2. Monitor the progress until the VM console shows that the vWLC has restarted (this is automatic).


File Edit View Inventory Administration Plug-ins Help
Home
Inventory
Inventory
10.10.10.10
Cisco Wirel
Cisco Wireless Lan Controller on localhost.localdomain
File View VM
Recent Tasks

```
Stage 1 boot completed, rebooting....
INIT: Switching to runlevel: 6
INIT: Sending processes the TERM signal
Stopping portmap daemon....
Sending all processes the TERM signal... done.
Sending all processes the KILL signal... done.
Stopping hotplug subsystem:
    pci
    pci       [success]
    usb
    usb       [success]
    isapnp
    isapnp    [success]
    ide
    ide       [success]
    input
    input     [success]
    scsi
    scsi      [success]
done.
Starting reboot command: reboot
Rebooting...
Restarting system.
```

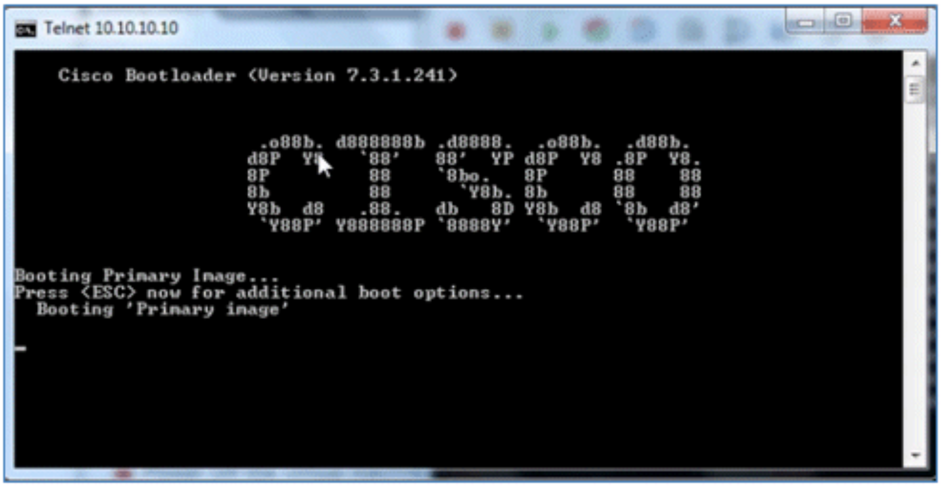
3. Open a Telnet session to the vWLC as shown here:


Cisco Wireless Lan Controller
Cisco Wireless Lan Controller on localhost.localdomain
File View VM
C:\Windows\system32\cmd.exe

```
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation.  All rights reserved.

C:\Users\Demo>telnet 10.10.10.10 9090
```

```
default terminal.
default terminal.
default terminal.
default terminal.
default terminal.
default terminal.
default terminal.
default terminal.
default terminal.
default terminal.
default terminal.
default terminal.
```

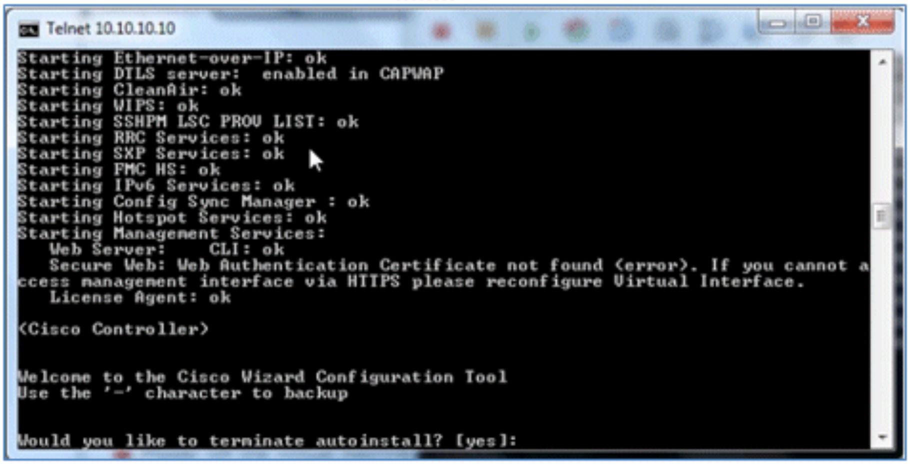
4. The Telnet session will now manage the console to the vWLC.



```
   Cisco Bootloader (Version 7.3.1.241)


                     .o88b. d888888b .d8888.  .o88b.  .d88b.
                    d8P  Y8   `88'   88'  YP d8P  Y8 .8P  Y8.
                    8P         88    `8bo.   8P      88    88
                    8b         88      `Y8b. 8b      88    88
                    Y8b  d8   .88.   db   8D Y8b  d8 `8b  d8'
                     `Y88P' Y888888P `8888Y'  `Y88P'  `Y88P'


Booting Primary Image...
Press <ESC> now for additional boot options...
  Booting 'Primary image'

_
```

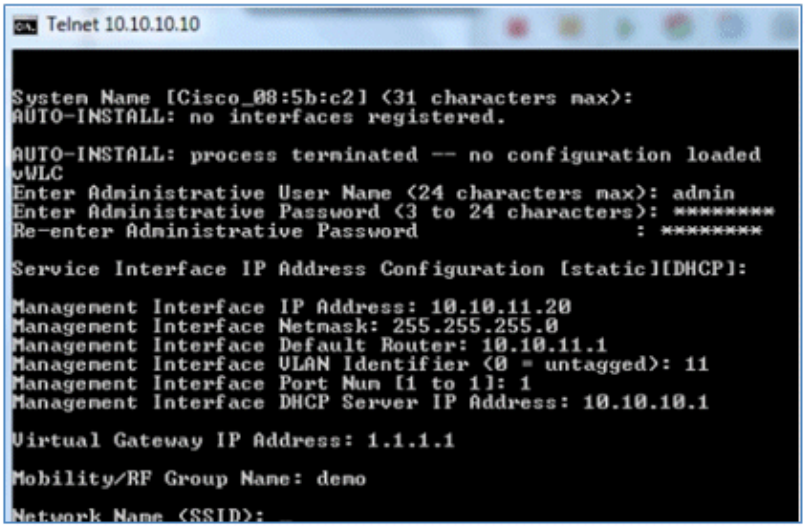
Note: Only one mode of console can be operational at any time, such as a VM console (by key−interrupt at startup) or serial console (physical/network). It is not possible to maintain both at the same time.

5. Continue to wait until the vWLC has come online fully and prompts you to start the configuration tool wizard.



```
Starting Ethernet-over-IP: ok
Starting DTLS server:  enabled in CAPWAP
Starting CleanAir: ok
Starting WIPS: ok
Starting SSHPM LSC PROV LIST: ok
Starting RRC Services: ok
Starting SXP Services: ok
Starting FMC HS: ok
Starting IPv6 Services: ok
Starting Config Sync Manager : ok
Starting Hotspot Services: ok
Starting Management Services:
   Web Server:    CLI: ok
   Secure Web: Web Authentication Certificate not found (error). If you cannot a
ccess management interface via HTTPS please reconfigure Virtual Interface.
   License Agent: ok

(Cisco Controller)


Welcome to the Cisco Wizard Configuration Tool
Use the '-' character to backup


Would you like to terminate autoinstall? [yes]:
```

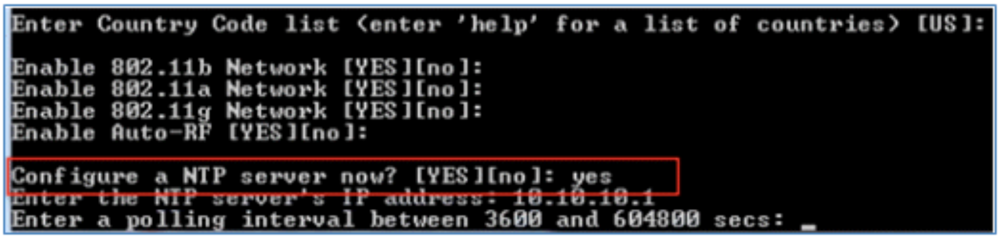
6. Configure the management interface address / mask / gateway. Configure Management Interface VLAN ID if tagged. Continue with the remainder.



```

System Name [Cisco_08:5b:c2] (31 characters max):
AUTO-INSTALL: no interfaces registered.

AUTO-INSTALL: process terminated -- no configuration loaded
vWLC
Enter Administrative User Name (24 characters max): admin
Enter Administrative Password (3 to 24 characters): ********
Re-enter Administrative Password                   : ********

Service Interface IP Address Configuration [static][DHCP]:

Management Interface IP Address: 10.10.11.20
Management Interface Netmask: 255.255.255.0
Management Interface Default Router: 10.10.11.1
Management Interface VLAN Identifier (0 = untagged): 11
Management Interface Port Num [1 to 1]: 1
Management Interface DHCP Server IP Address: 10.10.10.1

Virtual Gateway IP Address: 1.1.1.1

Mobility/RF Group Name: demo

Network Name (SSID): _
```

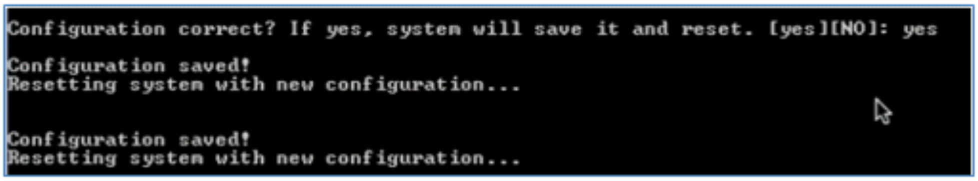
7. Similar to all network device(s), configuring the NTP is crucial. The virtual controller must have the correct clock as it is possible to have an incorrect clock on the ESX host, or from manual

configuration, which may result in APs not joining in the process.



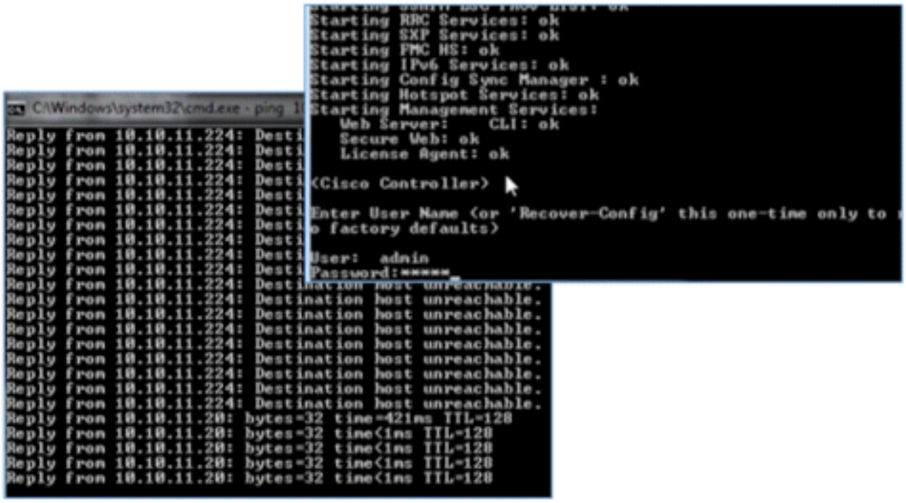
```
Enter Country Code list (enter 'help' for a list of countries) [US]:

Enable 802.11b Network [YES][no]:
Enable 802.11a Network [YES][no]:
Enable 802.11g Network [YES][no]:
Enable Auto-RF [YES][no]:

Configure a NTP server now? [YES][no]: yes
Enter the NTP server's IP address: 10.10.10.1
Enter a polling interval between 3600 and 604800 secs: _
```

8. Complete the configuration and allow the vWLC to reset.



```
Configuration correct? If yes, system will save it and reset. [yes][NO]: yes

Configuration saved!
Resetting system with new configuration...


Configuration saved!
Resetting system with new configuration...
```

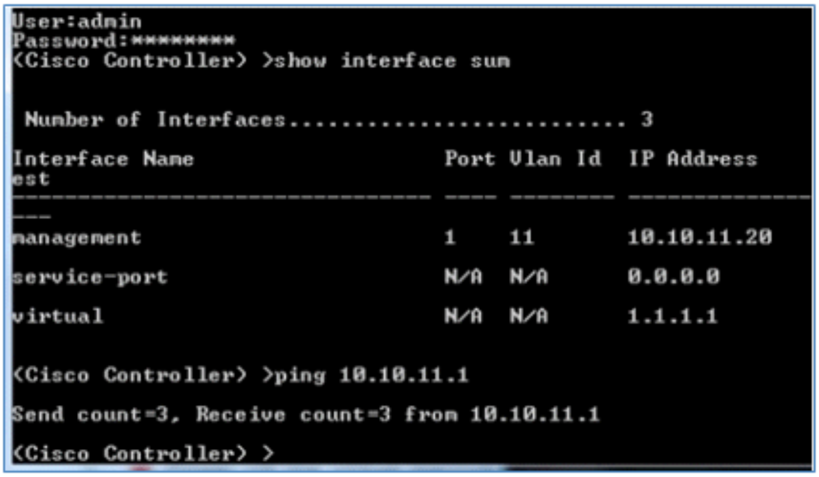
9. It is suggested that you ping the vWLC management interface in order to ensure that it has come online. Log in to the vWLC.



```
C:\Windows\system32\cmd.exe - ping 1
Reply from 10.10.11.224: Desti
Reply from 10.10.11.224: Desti
Reply from 10.10.11.224: Desti
Reply from 10.10.11.224: Desti
Reply from 10.10.11.224: Desti
Reply from 10.10.11.224: Desti
Reply from 10.10.11.224: Desti
Reply from 10.10.11.224: Desti
Reply from 10.10.11.224: Desti
Reply from 10.10.11.224: Desti
Reply from 10.10.11.224: Destination host unreachable.
Reply from 10.10.11.224: Destination host unreachable.
Reply from 10.10.11.224: Destination host unreachable.
Reply from 10.10.11.224: Destination host unreachable.
Reply from 10.10.11.224: Destination host unreachable.
Reply from 10.10.11.224: Destination host unreachable.
Reply from 10.10.11.224: Destination host unreachable.
Reply from 10.10.11.224: Destination host unreachable.
Reply from 10.10.11.224: Destination host unreachable.
Reply from 10.10.11.20: bytes=32 time=421ms TTL=128
Reply from 10.10.11.20: bytes=32 time<1ms TTL=128
Reply from 10.10.11.20: bytes=32 time<1ms TTL=128
Reply from 10.10.11.20: bytes=32 time<1ms TTL=128
Reply from 10.10.11.20: bytes=32 time<1ms TTL=128
```

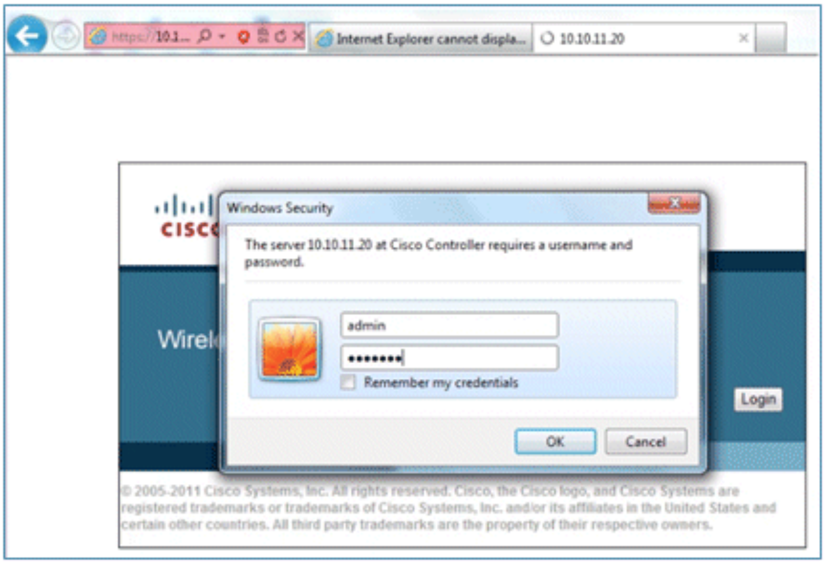
```
Starting RRC Services: ok
Starting SXP Services: ok
Starting FMC HS: ok
Starting IPv6 Services: ok
Starting Config Sync Manager : ok
Starting Hotspot Services: ok
Starting Management Services:
   Web Server:     CLI: ok
   Secure Web: ok
   License Agent: ok

(Cisco Controller)

Enter User Name (or 'Recover-Config' this one-time only to
o factory defaults)

User:  admin
Password:******_
```

10. You can issue the **show interface summary** command and ping the gateway from the vWLC.



```
User:admin
Password:********
(Cisco Controller) >show interface sum


 Number of Interfaces.......................... 3

Interface Name                   Port Vlan Id  IP Address
est
-------------------------------- ---- -------- --------------
---
management                       1    11       10.10.11.20

service-port                     N/A  N/A      0.0.0.0

virtual                          N/A  N/A      1.1.1.1


(Cisco Controller) >ping 10.10.11.1

Send count=3, Receive count=3 from 10.10.11.1

(Cisco Controller) >
```

11. Connect to vWLC management using a web browser



Windows Security

The server 10.10.11.20 at Cisco Controller requires a username and password.

admin

•••••••

□ Remember my credentials

OK Cancel

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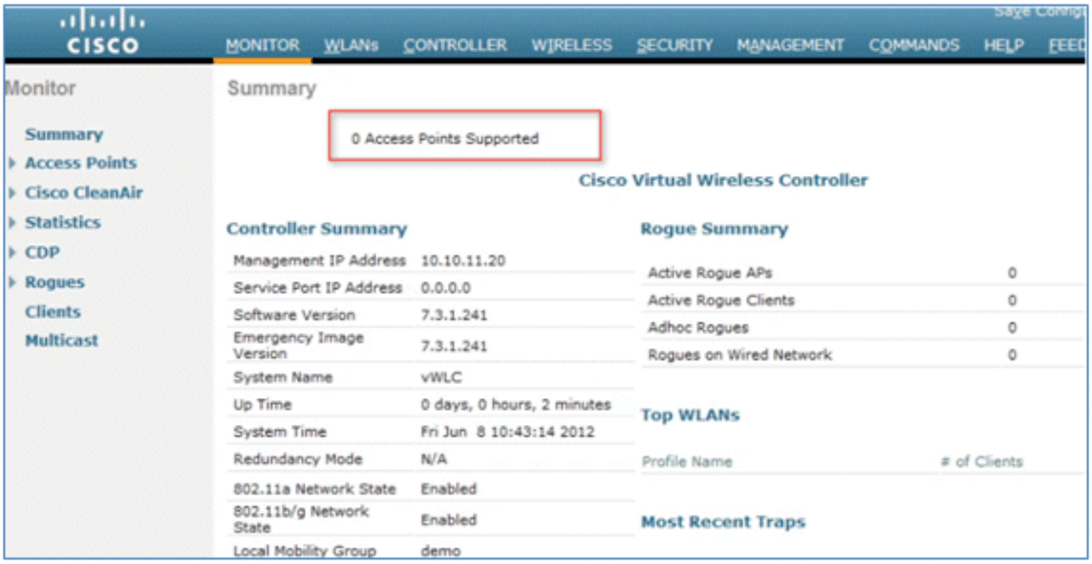
12. Initially, there are 0 (zero) Access Points Supported. Enable the evaluation license in order to allow the AP to join.



Summary

0 Access Points Supported

Cisco Virtual Wireless Controller

Controller Summary

Management IP Address	10.10.11.20
Service Port IP Address	0.0.0.0
Software Version	7.3.1.241
Emergency Image Version	7.3.1.241
System Name	vWLC
Up Time	0 days, 0 hours, 2 minutes
System Time	Fri Jun 8 10:43:14 2012
Redundancy Mode	N/A
802.11a Network State	Enabled
802.11b/g Network State	Enabled
Local Mobility Group	demo

Rogue Summary

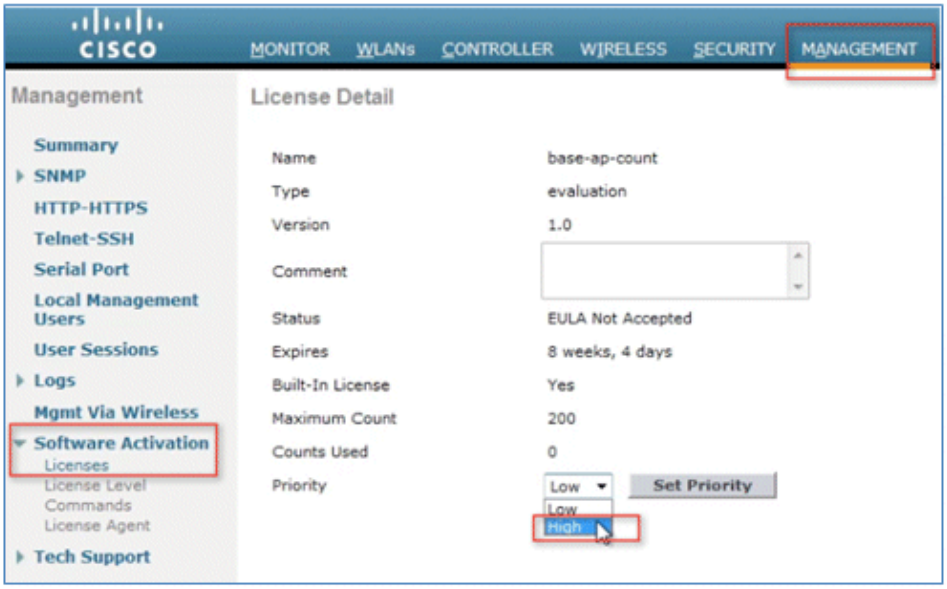
Active Rogue APs	0
Active Rogue Clients	0
Adhoc Rogues	0
Rogues on Wired Network	0

Top WLANs

Profile Name	# of Clients

Most Recent Traps

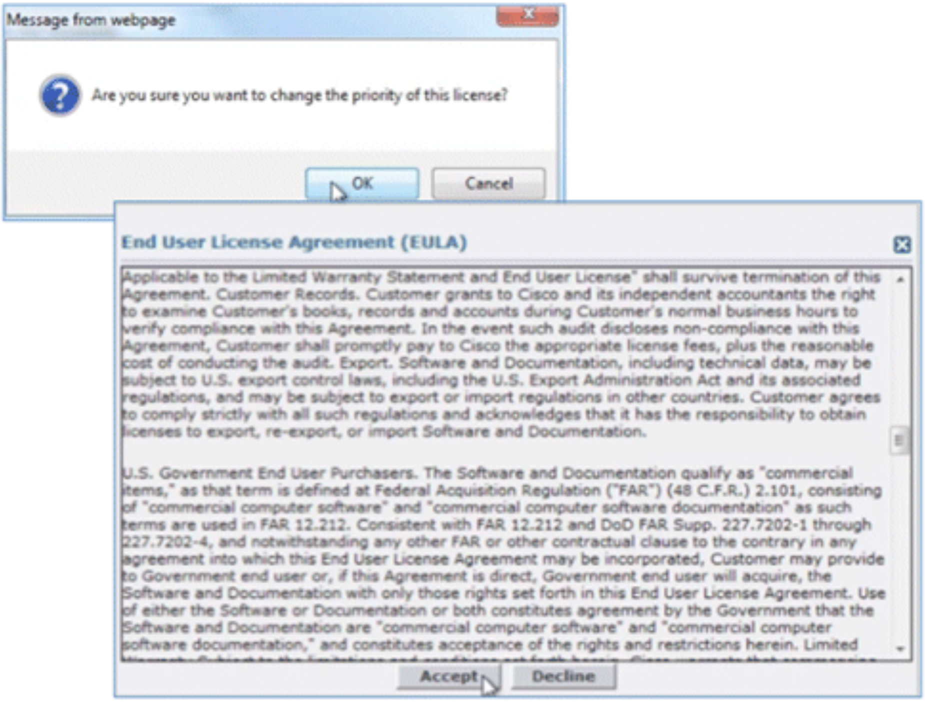
13. Go to **Management** > **Software Activation** > **Licenses**. Select **base−ap−count**, and set the Priority to **High**.



License Detail

Name	base-ap-count
Type	evaluation
Version	1.0
Comment	
Status	EULA Not Accepted
Expires	8 weeks, 4 days
Built-In License	Yes
Maximum Count	200
Counts Used	0
Priority	Low

14. Click **OK**, and **Accept** the EULA in order to continue.



Are you sure you want to change the priority of this license?

End User License Agreement (EULA)

Applicable to the Limited Warranty Statement and End User License" shall survive termination of this Agreement. Customer Records. Customer grants to Cisco and its independent accountants the right to examine Customer's books, records and accounts during Customer's normal business hours to verify compliance with this Agreement. In the event such audit discloses non-compliance with this Agreement, Customer shall promptly pay to Cisco the appropriate license fees, plus the reasonable cost of conducting the audit. Export. Software and Documentation, including technical data, may be subject to U.S. export control laws, including the U.S. Export Administration Act and its associated regulations, and may be subject to export or import regulations in other countries. Customer agrees to comply strictly with all such regulations and acknowledges that it has the responsibility to obtain licenses to export, re-export, or import Software and Documentation.

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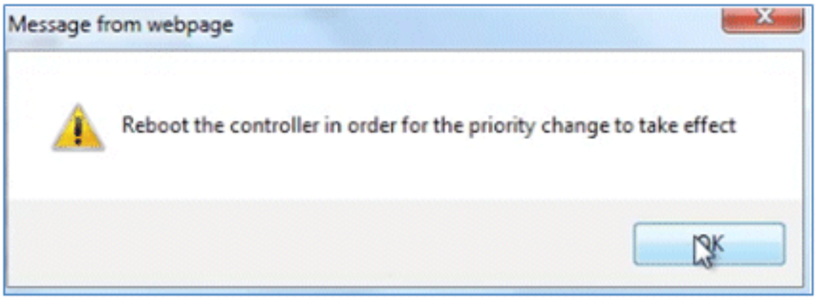
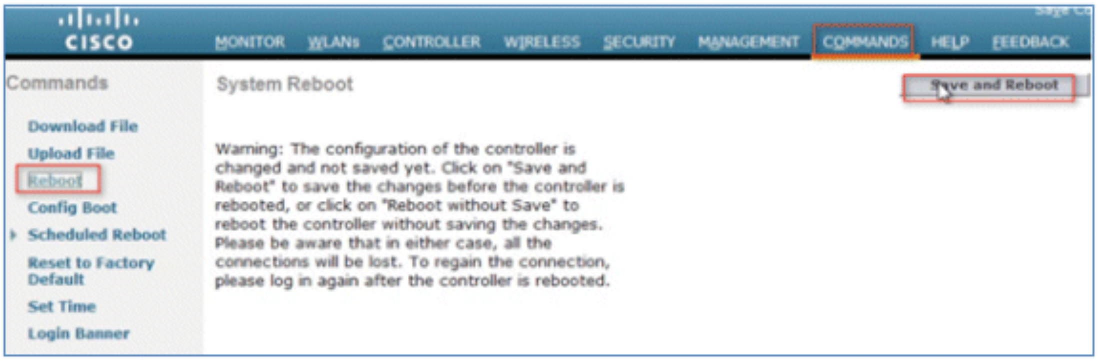
15. Click **OK**, and reset the vWLC in order for the evaluation license to take effect.



Reboot the controller in order for the priority change to take effect

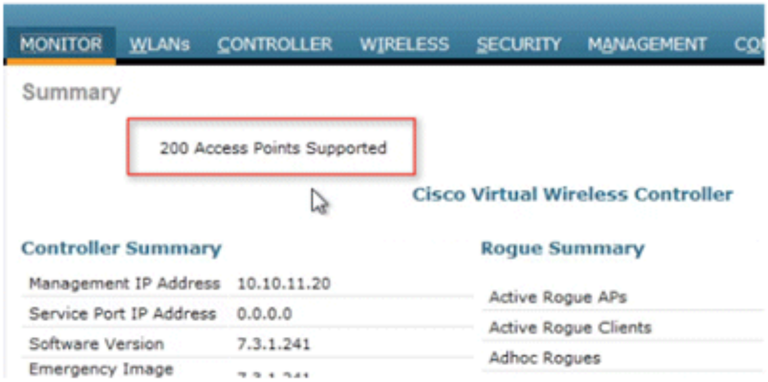
16. Reboot the vWLC.



System Reboot

Warning: The configuration of the controller is changed and not saved yet. Click on "Save and Reboot" to save the changes before the controller is rebooted, or click on "Reboot without Save" to reboot the controller without saving the changes. Please be aware that in either case, all the connections will be lost. To regain the connection, please log in again after the controller is rebooted.

17. Log back in to the vWLC, and note that the 200 APs are now supported with the evaluation license enabled.



Summary

200 Access Points Supported

Cisco Virtual Wireless Controller

Controller Summary

Management IP Address	10.10.11.20
Service Port IP Address	0.0.0.0
Software Version	7.3.1.241
Emergency Image	7.3.1.241

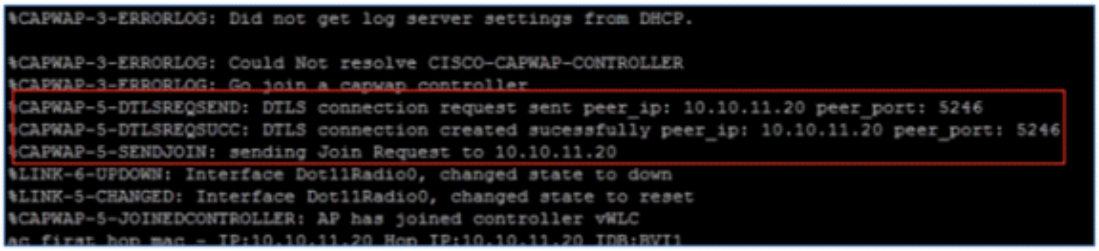
Rogue Summary

Active Rogue APs

Active Rogue Clients

Adhoc Rogues

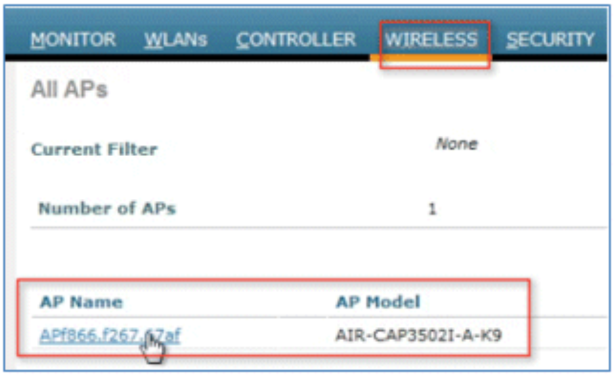
18. Connect an AP, and monitor for the join message to occur.



```
%CAPWAP-3-ERRORLOG: Did not get log server settings from DHCP.

%CAPWAP-3-ERRORLOG: Could Not resolve CISCO-CAPWAP-CONTROLLER
%CAPWAP-3-ERRORLOG: Go join a capwap controller
%CAPWAP-5-DTLSREQSEND: DTLS connection request sent peer_ip: 10.10.11.20 peer_port: 5246
%CAPWAP-5-DTLSREQSUCC: DTLS connection created sucessfully peer_ip: 10.10.11.20 peer_port: 5246
%CAPWAP-5-SENDJOIN: sending Join Request to 10.10.11.20
%LINK-6-UPDOWN: Interface Dot11Radio0, changed state to down
%LINK-5-CHANGED: Interface Dot11Radio0, changed state to reset
%CAPWAP-5-JOINEDCONTROLLER: AP has joined controller vWLC
ac first hop mac - IP:10.10.11.20 Hop IP:10.10.11.20 IDB:BVI1
```

19. From the browser, go to **WIRELESS** and confirm that the AP has joined.



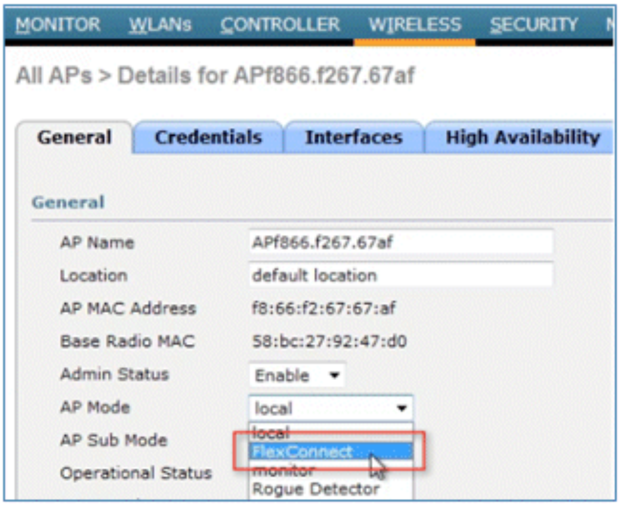
All APs

Current Filter None

Number of APs 1

AP Name	AP Model
APf866.f267.67af	AIR-CAP3502I-A-K9

20. Click the AP, and change the AP Mode to **FlexConnect**. Only FlexConnect is supported (central and local switching) in the 7.3 release.



All APs > Details for APf866.f267.67af

General

AP Name APf866.f267.67af
Location default location
AP MAC Address f8:66:f2:67:67:af
Base Radio MAC 58:bc:27:92:47:d0
Admin Status Enable
AP Mode local
- local
- FlexConnect
- monitor
- Rogue Detector

AP Sub Mode
Operational Status

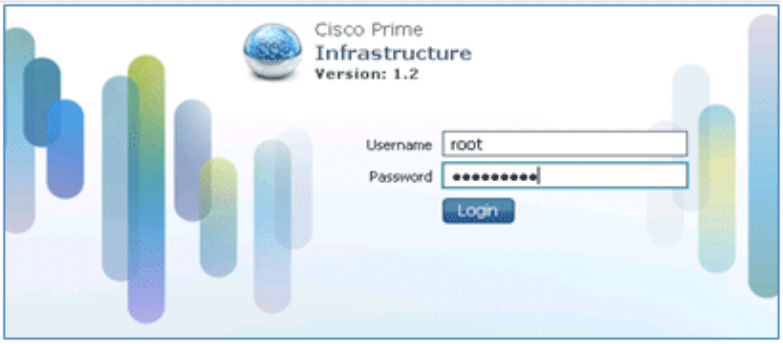
21. It may be useful to consider using the autoconvert function of the controller (for example, any mode AP joining the vWLC will be converted automatically to FlexConnect). Issue this command in order to implement:

```
(Cisco Controller) > config ap autoconvert flexconnect enable
```

Virtual Controller Management with Cisco Prime 1.2

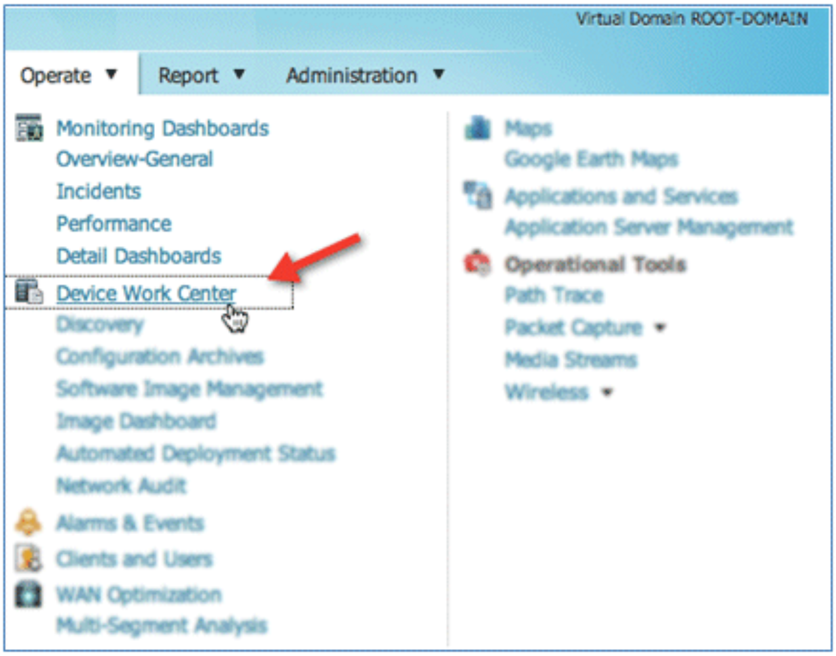
Cisco Prime Infrastructure version 1.2 is the minimum release required to centrally manage one or more Cisco Virtual Controller(s). Management for the Cisco Virtual Controller is no different than legacy physical controllers in comparison to Cisco WCS or NCS. Cisco Prime Infrastructure 1.2 provides configuration, software management, monitoring, reporting, and troubleshooting of virtual controllers. Refer to Cisco Prime Infrastructure documentation as required for administrative and management support.

1. Log in to Cisco Prime Infrastructure server as **root**. By default, the management view selection is Lifecycle Theme, which is new beginning with release version 1.2. The Classic Theme (shown later) will be more familiar to administrators who have been working in Cisco WCS and NCS.

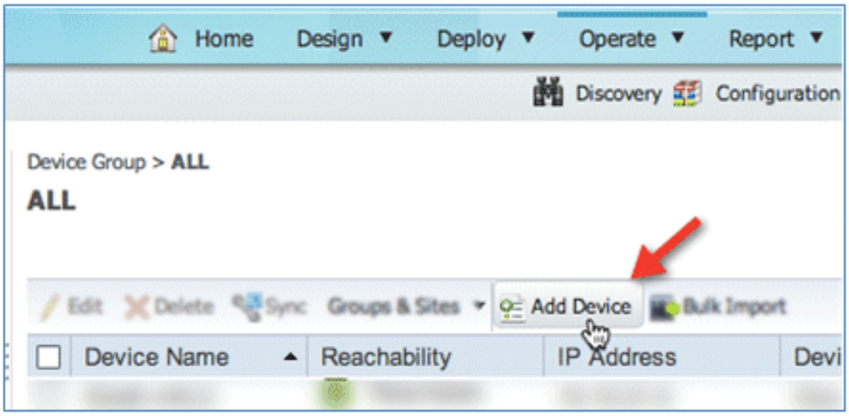


Username root
Password ●●●●●●●●●●

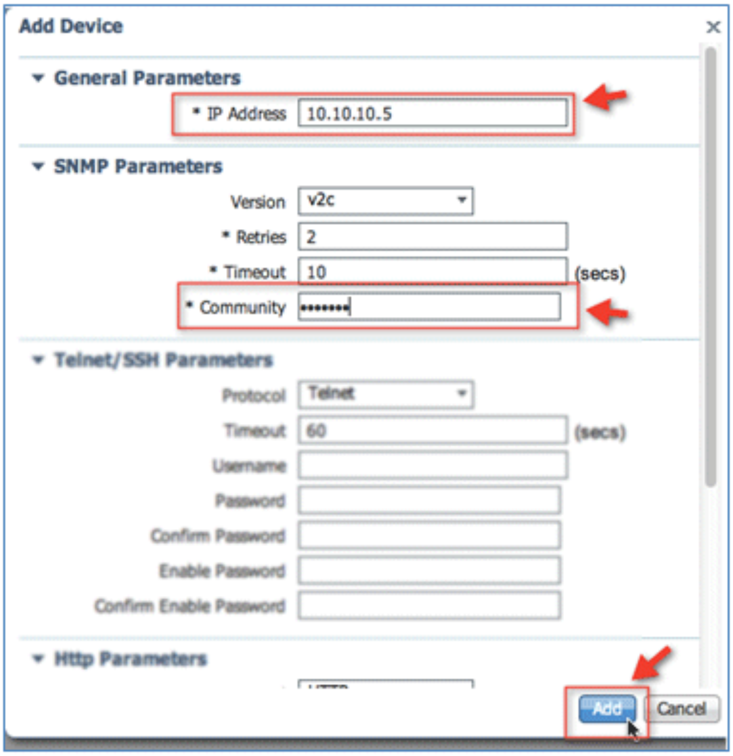
2. Go to **Operate** > **Device Work Center**.



3. In Device Work Center, click **Add Device**.



4. Enter the IP Address and SNMP Community string (Read/Write). By default, the SNMP RW for the controller is Private. Click **Add**.



Add Device

General Parameters

* IP Address: 10.10.10.5

SNMP Parameters

Version: v2c

* Retries: 2

* Timeout: 10 (secs)

* Community: •••••••

Telnet/SSH Parameters

Protocol: Telnet

Timeout: 60 (secs)

Username:

Password:

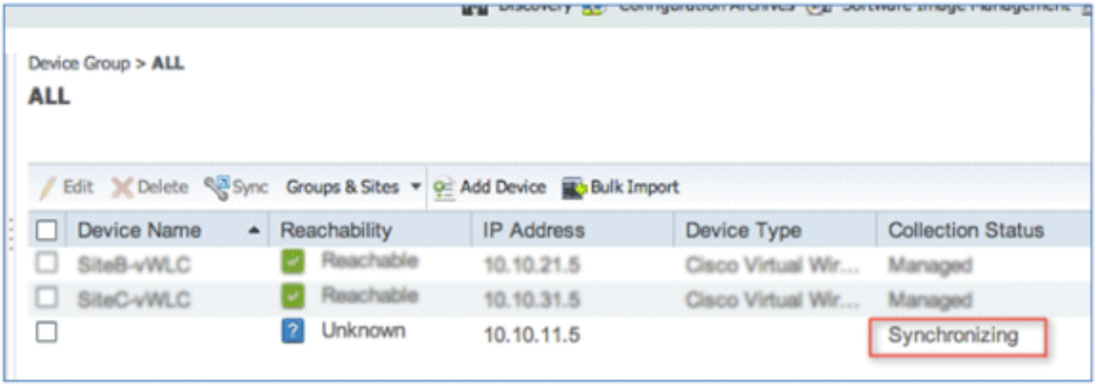
Confirm Password:

Enable Password:

Confirm Enable Password:

Http Parameters

5. Cisco Prime Infrastructure will discover and synchronize with the virtual controller. Click refresh in order to update the screen.

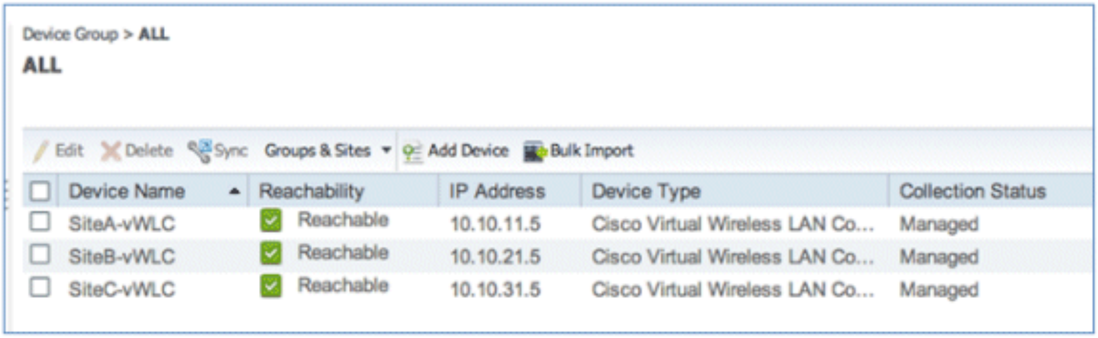


Device Group > ALL

ALL

☐	Device Name	Reachability	IP Address	Device Type	Collection Status
☐	SiteB-vWLC	✓ Reachable	10.10.21.5	Cisco Virtual Wir...	Managed
☐	SiteC-vWLC	✓ Reachable	10.10.31.5	Cisco Virtual Wir...	Managed
☐		? Unknown	10.10.11.5		Synchronizing

6. When the virtual controller is discovered, it is listed as Managed and Reachable (shown in green). Add any other virtual controller(s) at this point, if available.

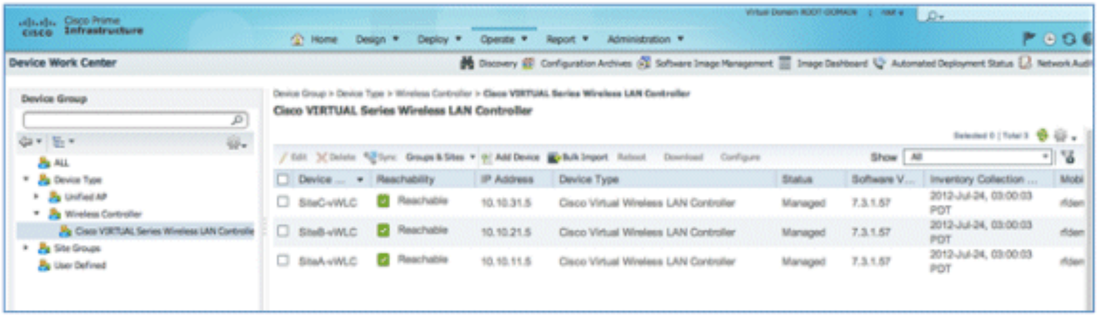


Device Group > ALL

ALL

☐	Device Name	Reachability	IP Address	Device Type	Collection Status
☐	SiteA-vWLC	✓ Reachable	10.10.11.5	Cisco Virtual Wireless LAN Co...	Managed
☐	SiteB-vWLC	✓ Reachable	10.10.21.5	Cisco Virtual Wireless LAN Co...	Managed
☐	SiteC-vWLC	✓ Reachable	10.10.31.5	Cisco Virtual Wireless LAN Co...	Managed

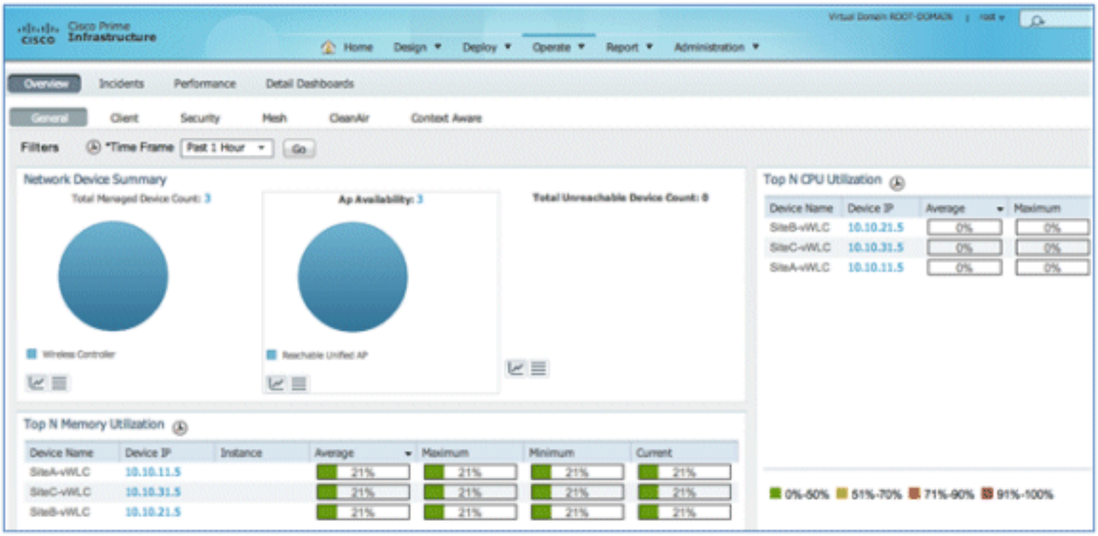
7. The new controller will be listed in **Device Type** > **Cisco VIRTUAL Series Wireless LAN Controller**.



Cisco VIRTUAL Series Wireless LAN Controller

Device ...	Reachability	IP Address	Device Type	Status	Software V...	Inventory Collection ...	Mobi
SiteC-vWLC	Reachable	10.10.31.5	Cisco Virtual Wireless LAN Controller	Managed	7.3.1.57	2012-Jul-24, 03:00:03 PDT	rfiden
SiteB-vWLC	Reachable	10.10.21.5	Cisco Virtual Wireless LAN Controller	Managed	7.3.1.57	2012-Jul-24, 03:00:03 PDT	rfiden
SiteA-vWLC	Reachable	10.10.11.5	Cisco Virtual Wireless LAN Controller	Managed	7.3.1.57	2012-Jul-24, 03:00:03 PDT	rfiden

8. Navigate to Home for a Summary view (in Lifecycle Theme) of the devices being managed.



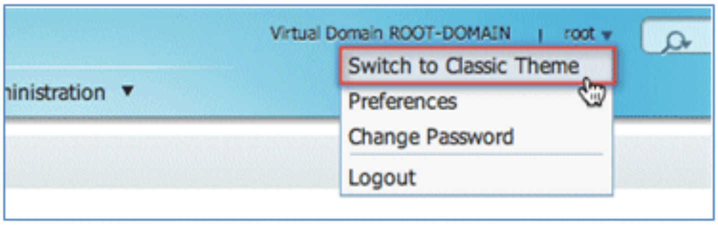
Top N CPU Utilization

Device Name	Device IP	Average	Maximum
SiteB-vWLC	10.10.21.5	0%	0%
SiteC-vWLC	10.10.31.5	0%	0%
SiteA-vWLC	10.10.11.5	0%	0%

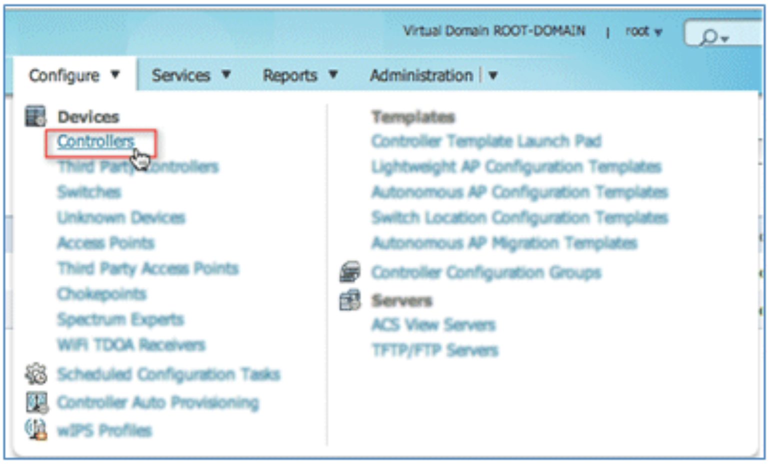
Top N Memory Utilization

Device Name	Device IP	Instance	Average	Maximum	Minimum	Current
SiteA-vWLC	10.10.11.5		21%	21%	21%	21%
SiteC-vWLC	10.10.31.5		21%	21%	21%	21%
SiteB-vWLC	10.10.21.5		21%	21%	21%	21%

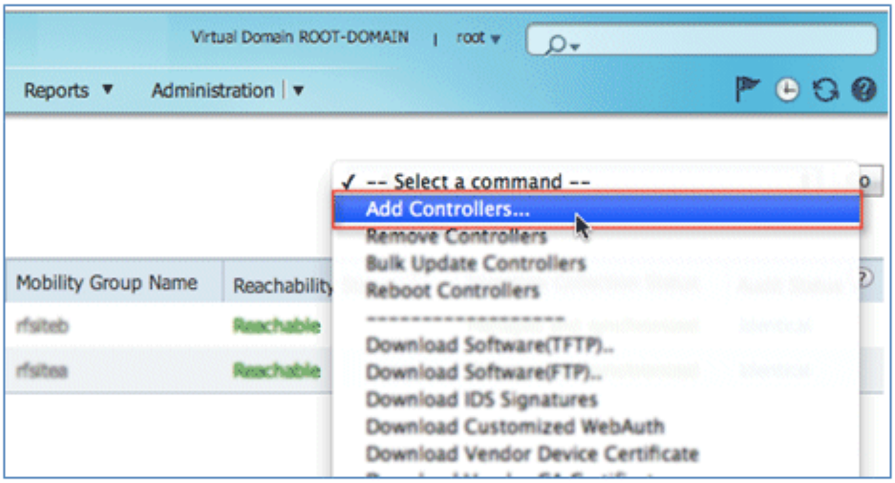
9. For the remainder of this guide, the Classic Theme is used to perform similar task of adding the virtual controller, as well as updating the system image. Go to and select **Switch to Classic Theme**.



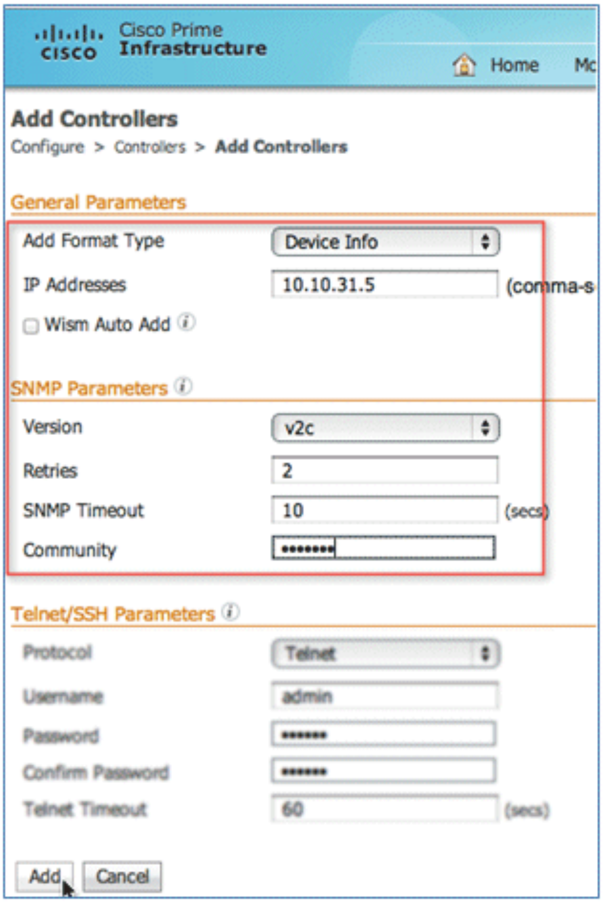
10. Go to **Configure** > **Controllers**.


Virtual Domain ROOT-DOMAIN | root
Configure
Services
Reports
Administration
Devices
Controllers
Third Party Controllers
Switches
Unknown Devices
Access Points
Third Party Access Points
Chokepoints
Spectrum Experts
WiFi TDOA Receivers
Scheduled Configuration Tasks
Controller Auto Provisioning
wIPS Profiles
Templates
Controller Template Launch Pad
Lightweight AP Configuration Templates
Autonomous AP Configuration Templates
Switch Location Configuration Templates
Autonomous AP Migration Templates
Controller Configuration Groups
Servers
ACS View Servers
TFTP/FTP Servers

11. In order to add a new virtual controller, select **Add Controllers...** from the Select a command drop−down list.



12. Enter the IP Address, Read/Write SNMP Community string, and click **Add**.



Add Controllers

Configure > Controllers > Add Controllers

General Parameters

Add Format Type	Device Info
IP Addresses	10.10.31.5 (comma-s
□ Wism Auto Add	

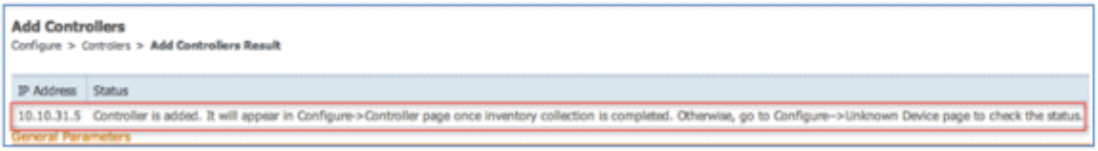
SNMP Parameters

Version	v2c
Retries	2
SNMP Timeout	10 (secs)
Community	••••••••

Telnet/SSH Parameters

Protocol	Telnet
Username	admin
Password	•••••••
Confirm Password	•••••••
Telnet Timeout	60 (secs)

13. Cisco Prime Infrastructure will display this notification:



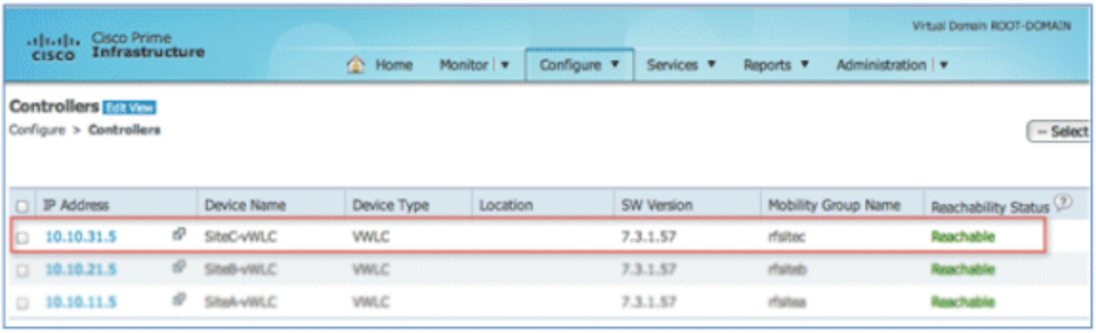
Add Controllers

Configure > Controllers > Add Controllers Result

IP Address	Status
10.10.31.5	Controller is added. It will appear in Configure->Controller page once inventory collection is completed. Otherwise, go to Configure-->Unknown Device page to check the status.

General Parameters

14. Go to **Configure** > **Controllers**. The virtual controller will be listed as Reachable once it has been successfully discovered and added. Otherwise, and as shown above, the device will appear in the Unknown Device page if it was not discovered successfully.



Controllers

Configure > Controllers

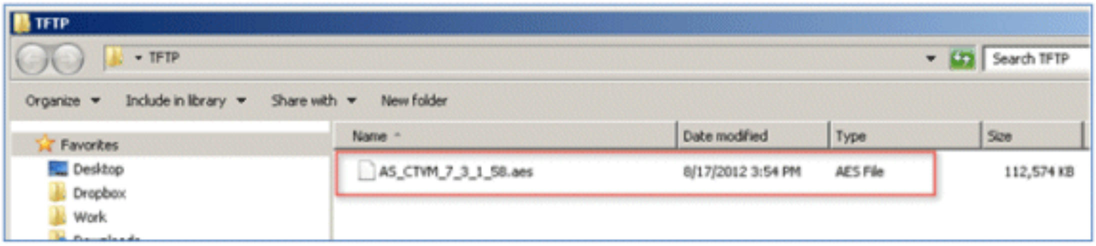
□	IP Address	Device Name	Device Type	Location	SW Version	Mobility Group Name	Reachability Status
□	10.10.31.5	SiteC-vWLC	vWLC		7.3.1.57	rfsitec	Reachable
□	10.10.21.5	SiteB-vWLC	vWLC		7.3.1.57	rfsiteb	Reachable
□	10.10.11.5	SiteA-vWLC	vWLC		7.3.1.57	rfsitea	Reachable

Upgrade the Virtual Controller

In the early steps of installation, the Cisco Virtual Controller initially required an OVA file for new virtual appliance creation. However, maintaining virtual controller features and software upgrades require a common AES file downloadable from the Cisco website.

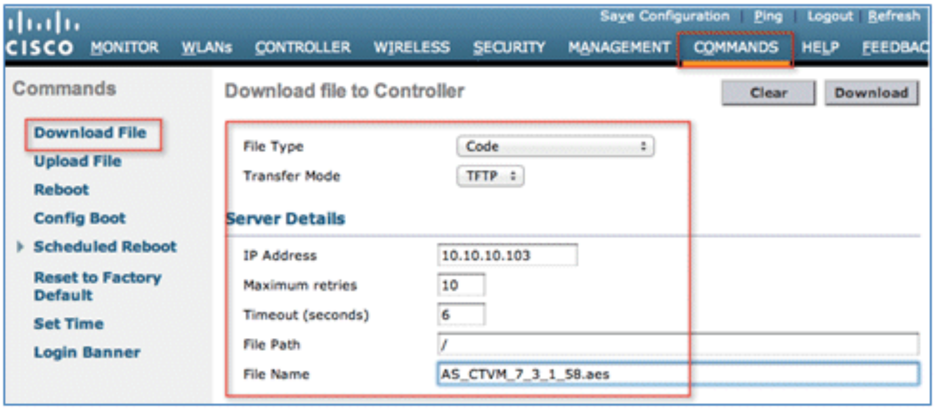
Complete these steps:

1. Download the AS*7_3*aes file to a target host (for example, the TFTP/FTP server).



Name	Date modified	Type	Size
AS_CTVM_7_3_1_58.aes	8/17/2012 3:54 PM	AES File	112,574 KB

2. Just as for legacy controllers, go to the web GUI of the controller > **COMMANDS** > **Download File**. Select the File Type, Transfer Mode, IP Address, File Path, and File Name (.aes file). Click **Download** in order to start the process.



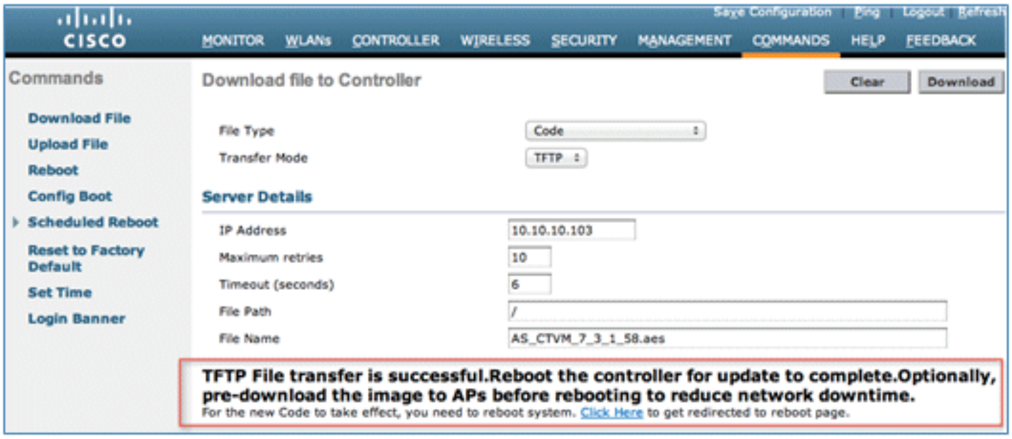
Download file to Controller

File Type	Code
Transfer Mode	TFTP

Server Details

IP Address	10.10.10.103
Maximum retries	10
Timeout (seconds)	6
File Path	/
File Name	AS_CTVM_7_3_1_58.aes

3. When the process has completed successfully, you are prompted to Reboot in order for the new software image to take effect. Click the link to the Reboot Page in order to continue.



Download file to Controller

File Type: Code

Transfer Mode: TFTP

Server Details

IP Address: 10.10.10.103

Maximum retries: 10

Timeout (seconds): 6

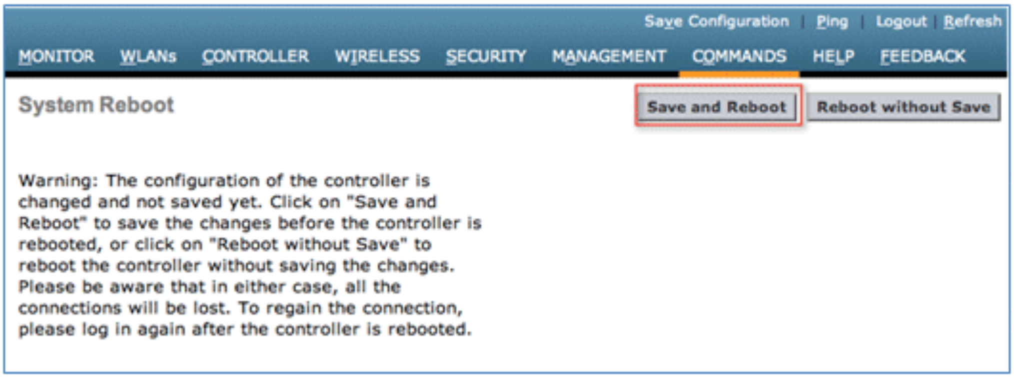
File Path: /

File Name: AS_CTVM_7_3_1_58.aes

TFTP File transfer is successful.Reboot the controller for update to complete.Optionally, pre-download the image to APs before rebooting to reduce network downtime.

For the new Code to take effect, you need to reboot system. Click Here to get redirected to reboot page.

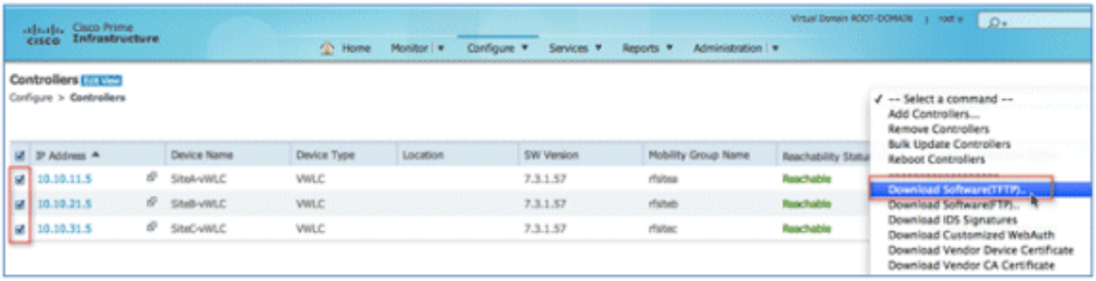
4. Click **Save and Reboot**.



System Reboot

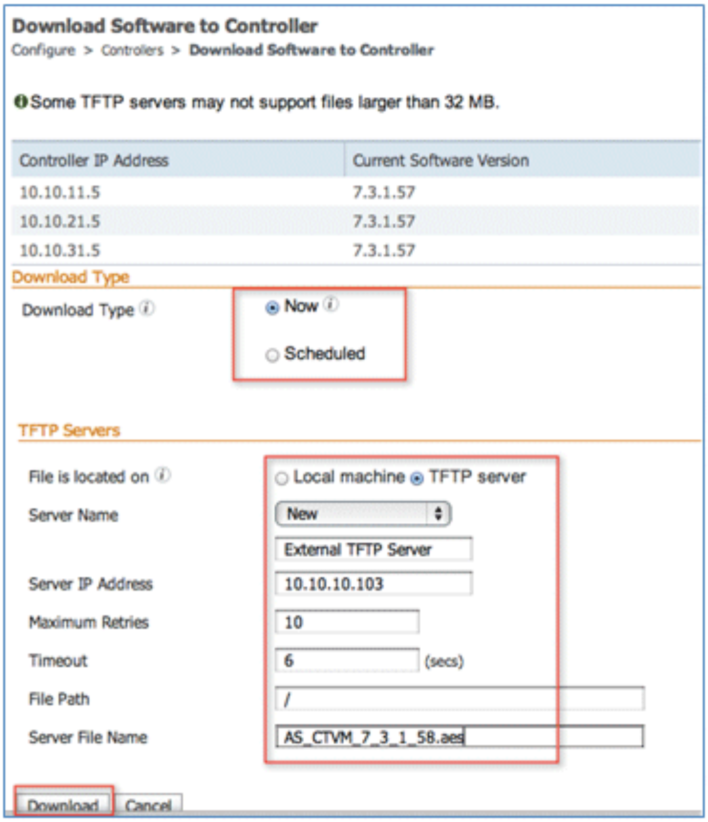
Warning: The configuration of the controller is changed and not saved yet. Click on "Save and Reboot" to save the changes before the controller is rebooted, or click on "Reboot without Save" to reboot the controller without saving the changes. Please be aware that in either case, all the connections will be lost. To regain the connection, please log in again after the controller is rebooted.

5. Cisco Prime Infrastructure can also be useful for upgrading one virtual controller or many virtual controllers at the same time. Go to **Configure** > **Controllers**. Select (check box) one or more virtual controllers. Select **Download Software (TFTP)** from the command drop−down list. This example uses TFTP mode for image upgrade.



☑	IP Address	Device Name	Device Type	Location	SW Version	Mobility Group Name	Reachability Status
☑	10.10.11.5	SiteA-vWLC	VWLC		7.3.1.57	rfsitea	Reachable
☑	10.10.21.5	SiteB-vWLC	VWLC		7.3.1.57	rfsiteb	Reachable
☑	10.10.31.5	SiteC-vWLC	VWLC		7.3.1.57	rfsitec	Reachable

6. Provide the Download Type, TFTP server (new if using external), IP Address, File Path, and Server File Name (which is the .aes file type). Click **Download**.



Download Software to Controller

Configure > Controllers > **Download Software to Controller**

Some TFTP servers may not support files larger than 32 MB.

Controller IP Address	Current Software Version
10.10.11.5	7.3.1.57
10.10.21.5	7.3.1.57
10.10.31.5	7.3.1.57

Download Type

Download Type: ● Now ○ Scheduled

TFTP Servers

File is located on: ○ Local machine ● TFTP server

Server Name: New

External TFTP Server

Server IP Address: 10.10.10.103

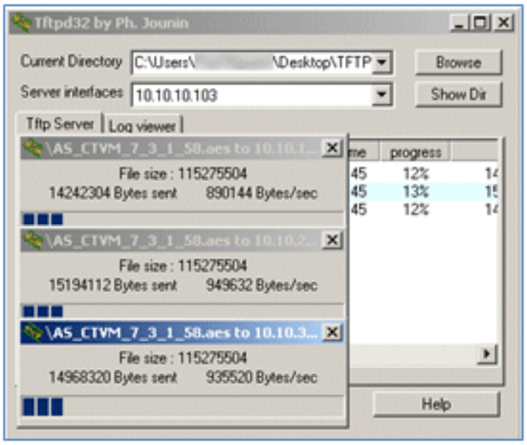
Maximum Retries: 10

Timeout: 6 (secs)

File Path: /

Server File Name: AS_CTVM_7_3_1_58.aes

7. This screen is an example of the AES image being transferred to the virtual controllers:



Current Directory: C:\Users\[redacted]\Desktop\TFTP

Server interfaces: 10.10.10.103

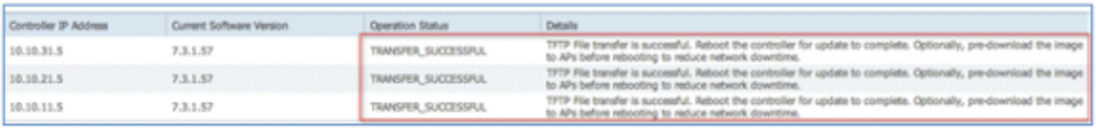
\AS_CTVM_7_3_1_58.aes to 10.10.1...
File size : 115275504
14242304 Bytes sent 890144 Bytes/sec

\AS_CTVM_7_3_1_58.aes to 10.10.2...
File size : 115275504
15194112 Bytes sent 949632 Bytes/sec

\AS_CTVM_7_3_1_58.aes to 10.10.3...
File size : 115275504
14968320 Bytes sent 935520 Bytes/sec

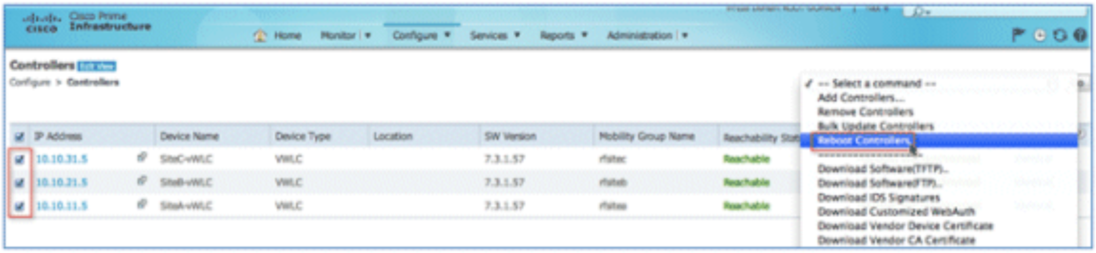
me	progress	
45	12%	14
45	13%	15
45	12%	14

8. Cisco Prime Infrastructure will update the status until the software has transferred successfully.



Controller IP Address	Current Software Version	Operation Status	Details
10.10.31.5	7.3.1.57	TRANSFER_SUCCESSFUL	TFTP File transfer is successful. Reboot the controller for update to complete. Optionally, pre-download the image to APs before rebooting to reduce network downtime.
10.10.21.5	7.3.1.57	TRANSFER_SUCCESSFUL	TFTP File transfer is successful. Reboot the controller for update to complete. Optionally, pre-download the image to APs before rebooting to reduce network downtime.
10.10.11.5	7.3.1.57	TRANSFER_SUCCESSFUL	TFTP File transfer is successful. Reboot the controller for update to complete. Optionally, pre-download the image to APs before rebooting to reduce network downtime.

9. Similar to the experience directly from the controller, a reboot is required when the transfer is complete. In Cisco Prime Infrastructure, go to **Configure** > **Controllers**, and select the virtual controller(s). Select **Reboot Controllers** from the Select a command... drop−down list.

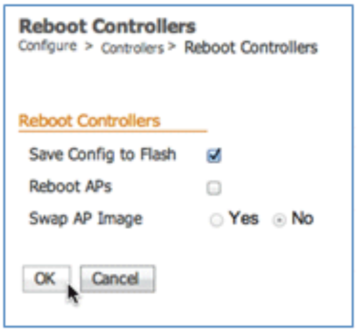


Controllers
Configure > Controllers

☑	IP Address	Device Name	Device Type	Location	SW Version	Mobility Group Name	Reachability Status
☑	10.10.31.5	SiteC-vWLC	vWLC		7.3.1.57	rfsitec	Reachable
☑	10.10.21.5	SiteB-vWLC	vWLC		7.3.1.57	rfsiteb	Reachable
☑	10.10.11.5	SiteA-vWLC	vWLC		7.3.1.57	rfsitea	Reachable

-- Select a command --
Add Controllers...
Remove Controllers
Bulk Update Controllers
Reboot Controllers
Download Software(TFTP)...
Download Software(FTP)...
Download IDS Signatures
Download Customized WebAuth
Download Vendor Device Certificate
Download Vendor CA Certificate

10. Cisco Prime Infrastructure will prompt for reboot parameters such as save configuration, and so forth. Click **OK**.

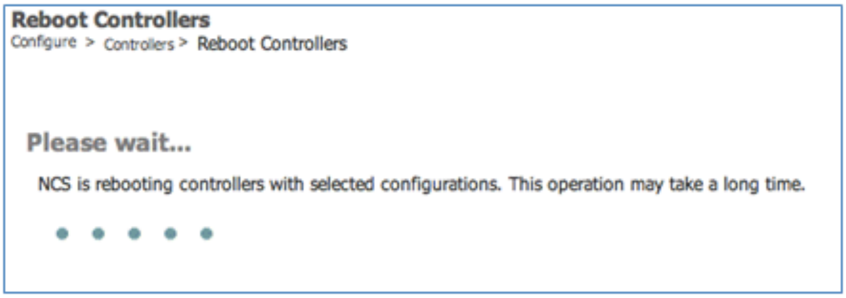


Reboot Controllers
Configure > Controllers > Reboot Controllers

Reboot Controllers

Save Config to Flash ☑
Reboot APs □
Swap AP Image ○ Yes ● No

11. Cisco Prime Infrastructure will notify the administrator that the virtual controllers are being rebooted.

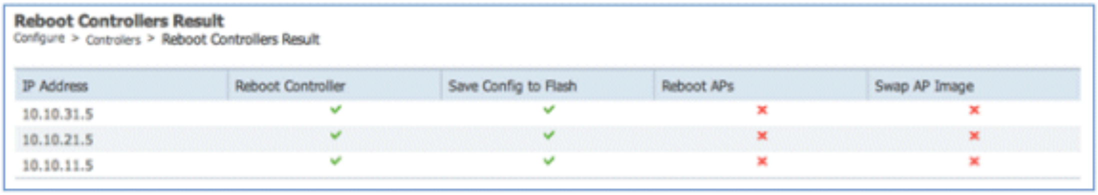


Reboot Controllers
Configure > Controllers > Reboot Controllers

Please wait...

NCS is rebooting controllers with selected configurations. This operation may take a long time.

12. When complete, Cisco Prime Infrastructure will provide the results of the process.



Reboot Controllers Result
Configure > Controllers > Reboot Controllers Result

IP Address	Reboot Controller	Save Config to Flash	Reboot APs	Swap AP Image
10.10.31.5	✓	✓	✗	✗
10.10.21.5	✓	✓	✗	✗
10.10.11.5	✓	✓	✗	✗

Troubleshooting

AP Considerations

Known Issue: AP(s) not joining vWLC − The AP must get the hash entry from a legacy controller before it joins a vWLC.

- An AP must be at software version 7.3.1.35 and above to successfully join a virtual controller. Virtual controllers use SSC in order to validate an AP before joining.
- An AP at version 7.3 can validate the SSC certificate provided by the virtual controller.
- After successful certificate validation, an AP will check the hash key of the virtual controller in the list of stored keys in flash. If it matches the stored hash, validation is passed and the AP moves to the RUN state. If hash validation fails, it will disconnect from the controller and restart the discovery process.

- The hash validation, which is an extra authorization step, will be performed only if the AP is joining a virtual controller. There will be a knob to turn on/off hash key validation.
- By default, hash validation is enabled, which means that the AP needs to have the virtual controller hash key in its flash before it can successfully complete association with the virtual controller. If the knob is turned off, the AP will bypass the hash validation and move directly to the RUN state.
- The hash key can be configured in the controller mobility configurations, which gets pushed to all the APs which are joined. The AP will save this configuration until it successfully associates to another controller. After which, it inherits the hash key configuration from the new controller.
- Typically, APs can join a traditional controller, download the hash keys, and then join a virtual controller. However, if it is joined to a traditional controller, the hash validation knob can be turned off and it can join any virtual controller. The administrator can decide to keep the knob on or off

This information is captured in Cisco bug ID CSCua55382.

Exceptions:

- If the AP does not have any hash key in its flash, it will bypass the hash validation, assuming that it is a first time installation.
    - In this case, the hash validation is bypassed irrespective of whether the hash validation knob is on/off.
    - Once it successfully joins the controller, it will inherit the mobility group member hash configuration (if configured in the controller). After which, it can join a virtual controller only if it has a hash key entry in its database.
- Clearing the AP configuration from the controller or on the AP console will result in the erasing of all the hash keys. After which, the AP joins the virtual controller as if it is a first time installation.
    - `AP> test capwap erase`
    - `AP> test capwap restart`

Time is Incorrect

- At initial install, it is possible that the time may be skewed or not properly synced. As a result, the AP may not be able to join properly. In this instance, check the SSC validity time stamp in order to ensure that it is correct. NTP is always recommended going forward.

```
(Cisco Controller) >show certificate ssc
SSC Hash validation............................. Enabled.

SSC Device Certificate details:

  Subject Name :
   C=US, ST=California, L=San Jose, O=Cisco Virtual Wireless LAN Controller,
   CN=DEVICE-vWLC-AIR-CTVM-K9-000C29085BB8, MAILTO=support@vwlc.com

  Validity :
                 Start : 2012 Jun  8th, 17:52:46 GMT
                 End   : 2022 Apr 17th, 17:52:46 GMT

         Hasbd7bb60436202e830802be1e8931d539b67b2537
```

SSC Hash

- The AP is a new AP with 7.3 and does NOT have hash can join virtual WLC readily:

```
ap#show capwap client config
```

- The AP may have an older SSC hash, either from an old installation or joining other controllers. It is possible to configure the WLC to not validate SSC, allow APs to join the vWLC, then re−enabling the validation again.

```
(Cisco Controller) >configure certificate ssc hash validation disable
```

- Perform the **test capwap** <*erase/restart*> command in order to clear AP capwap settings and initiate join process.

```
APf866.f267.67af#test capwap erase
APf866.f267.67af#test capwap restart
restart capwap
APf866.f267.67af#
*Jun  9 12:27:22.469: %DTLS−5−SEND_ALERT: Send FATAL : Close notify Alert to
   10.10.11.20:5246
*Jun  9 12:27:22.525: %WIDS−6−DISABLED: IDS Signature is removed and disabled.
*Jun  9 12:27:22.529: %LWAPP−3−CLIENTERRORLOG: LWAPP LED Init: incorrect led
   state 255
*Jun  9 12:27:22.897: Starting Ethernet promiscuous mode
*Jun  9 12:27:32.903: %CAPWAP−3−ERRORLOG: Go join a capwap controller
*Jun  9 12:27:23.000: %CAPWAP−5−DTLSREQSEND: DTLS connection request sent
   peer_ip: 10.10.11.20 peer_port: 5246
*Jun  9 12:27:23.276: %CAPWAP−5−DTLSREQSUCC: DTLS connection created
   successfully peer_ip: 10.10.11.20 peer_port: 5246
*Jun  9 12:27:23.276: %CAPWAP−5−SENDJOIN: sending Join Request to 10.10.11.20
```

- As part of the mobility configuration, if there is a virtual controller in the network, the administrator needs to add a hash key of the virtual controller in all the peer controllers. If adding another peer controller, the consideration is to add the hash (shown in the SSC output above) to the mobility group member.

```
(Cisco Controller) >config mobility group member add 10.10.11.30
(Cisco Controller) >config mobility group member hash 10.10.11.30
   bd7bb60436202e830802be1e8931d539b67b2537
```

Related Information

- **FlexConnect Feature Matrix**
- **Cisco LAP Documentation**
- **Flex 7500 Wireless Branch Controller Deployment Guide**
- **Technical Support & Documentation − Cisco Systems**

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